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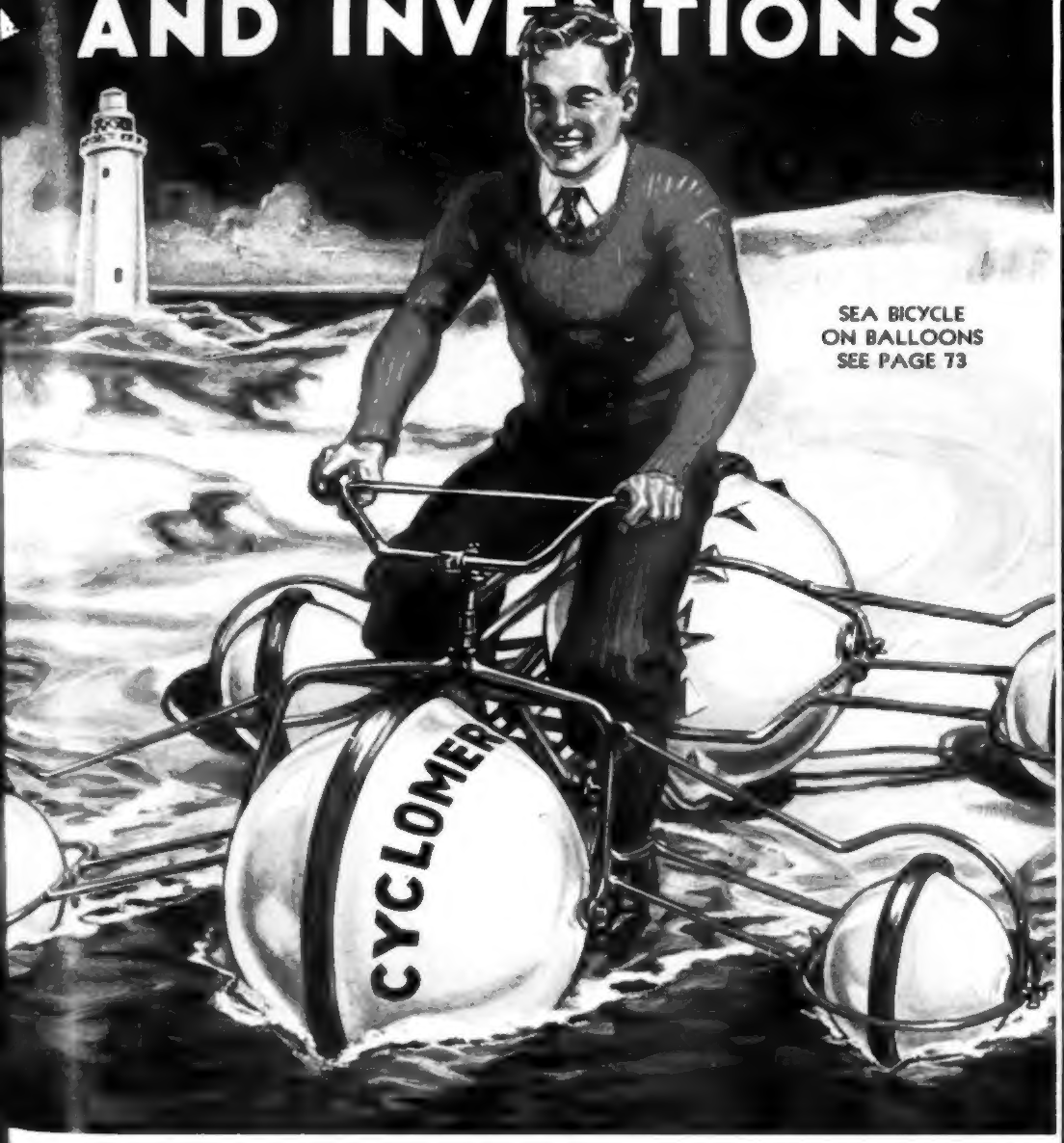
MODERN MECHANIX AND INVENTIONS



SEA BICYCLE
ON BALLOONS
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IDEAS FOR MAKING MONEY

BEWARE RUPTURE

THAT "DOESN'T BOTHER MUCH"

Suction Cell Retainer is the newest invention for rupture. No bulk, no slipping. Holds and lets Nature heal.

Light as a Feather

Yet Holds Rupture!

An Ohio Scientist Is Now Helping Nature Rescue Thousands of Rupture Victims. No More Cruelty. No More Cumbersome Contraptions of ancient times. His new appliance works without embarrassing bulk, without leg straps or springs or bars or leather. You will be astonished at its tiny size, its revolutionary coolness and convenience. His test offer actually includes an extra appliance sent to you absolutely FREE. Mail coupon today for the most astounding rupture information you ever read. It is Free and will come in plain cover.

NOW rupture victims can abandon the needless pain and discomfort of torturous trusses. Science has at last developed a tiny, comfortable appliance of tremendous interest for every rupture sufferer. This device is called "Suction Cell Retainer." It has been developed and perfected as a result of having made more than a million rupture appliances. With it comes an astounding natural help for putting real strength into the abdomen, so as to aid Nature in preventing recurrence of rupture.

Results with Suction Cell Retainer are often so remarkable, so quick, so simple, that you too may marvel. It has no leg straps. It expands and contracts as easily as your own flesh. When you walk, run, bend, or exercise it tends to squeeze itself, not the part of your body it rests against. It is so entirely lacking in bulk and weight that even some ruptured men's wives have not known they were ruptured.

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Suction Cell Retainer must give the results that you expect or you simply return it. If your rupture is not actually and positively reduced in size during the free trial we allow, send it back and demand the return of your deposit as agreed. If 30 days' trial are not enough, write us and we will extend the time to 60, 90 days or even four months if you desire.

Think what the above words promise, not only in new comfort and immediate relief, but also the possibility of ultimate FREEDOM! No system like this ever devised! At last, comes sensible relief. Pleasant. Solid Comfort. Natural way. Reasonable in price. And you don't need to wait forever for results.

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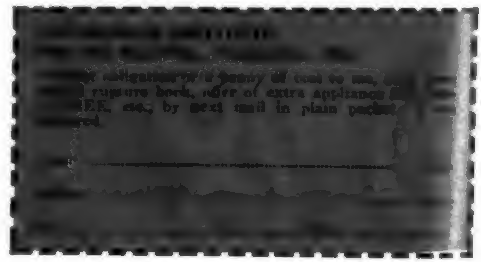
NEW SCIENCE INSTITUTE
2503 New Bank Bldg. Steubenville, Ohio



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INVENTOR OF ERECTOR

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December, 1932
VOLUME IX
NUMBER 2

MODERN MECHANIX AND INVENTIONS

DONALD COOLEY
Editor

PRICE 25 CENTS
30 Cents in Canada

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They Told Him Salesmen Were "Born"

But Now He Makes $10,000 a Year ...Thanks to This Little Book

IT WAS just a little free book that showed Ed Pinkham that he could be different from the rest of the men in our shop. Nobody ever imagined that Ed would land, even in the $5,000-a-year class, let alone be making $10,000 before he was thirty. Ed didn't know himself the abilities he had in him as a money-maker.

But one day, a strange occurrence changed his whole life. During his lunch hour Ed started to read a little book he had brought to work with him.

"It's a book called 'The Key To Master Salesmanship,' Bill," he told me. "It's the most amazing thing I ever read. I never dreamed there was so much in salesmanship. You ought to send for a copy yourself. It's free."

"Huh!" said Luke Jones. "Does that book tell you how to become a salesman?"

"It sure does," replied Ed, enthusiastically.

"Don't waste your time," advised Luke. "You can't learn how to be a salesman. A fellow has to be 'born' that way to be a good salesman."

Ed just smiled at that, but he said nothing. Soon afterward he quit the shop, and we forgot about him. And then last night, I met Ed again—driving a snappy new sedan and dressed like a million dollars.

"For Pete's sake," I said. "What are you doing nowadays, Ed?" He smiled. "City sales manager for the Steel Castings Company," he told me. "What are you doing?"

"Still at the shop," I replied. "But what I want to know is, how do you come to be sales manager for Steel Castings? They're one of the biggest firms in the business."

Ed smiled again. "Remember that book on Salesmanship that Luke Jones was kidding me about one day? Well, when I finished my Salesmanship training the Association I took it from gave me a choice of a number of jobs through their Free Employment Department, and I took a position as salesman for Steel Castings Company. They made me City Sales Manager three months ago at ten thousand dollars a year."

"Good night!" I said. "And Luke and I are still punching the old time clock!"

Ed looked at me seriously. "See here, Bill," he said. "Are you sport enough to risk two cents that you can do as well as I did? Then spend the two cents to write to the National Salesmen's Training Association tonight and get their free book. Then take their course. When you are qualified, their Free Employment Department will help you get a good sales job. Not only will they help you get the job but they agree under an iron-clad money-back penalty that you must be satisfied with the training received—or they refund your tuition!"

FREE—TO EVERY MAN

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Chicago, Ill.

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Address .....

City ..... State .....

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EDITED BY EXPERTS

Listed here are the members of the Modern Mechanix Board of Editors, all qualified by national repute to serve as authorities. They will gladly answer questions from readers if stamped envelope is sent. Address them in care of this magazine, 529 S. 7th St., Minneapolis, Minn.

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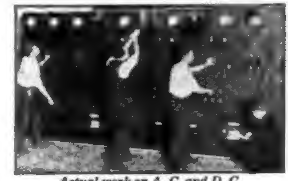

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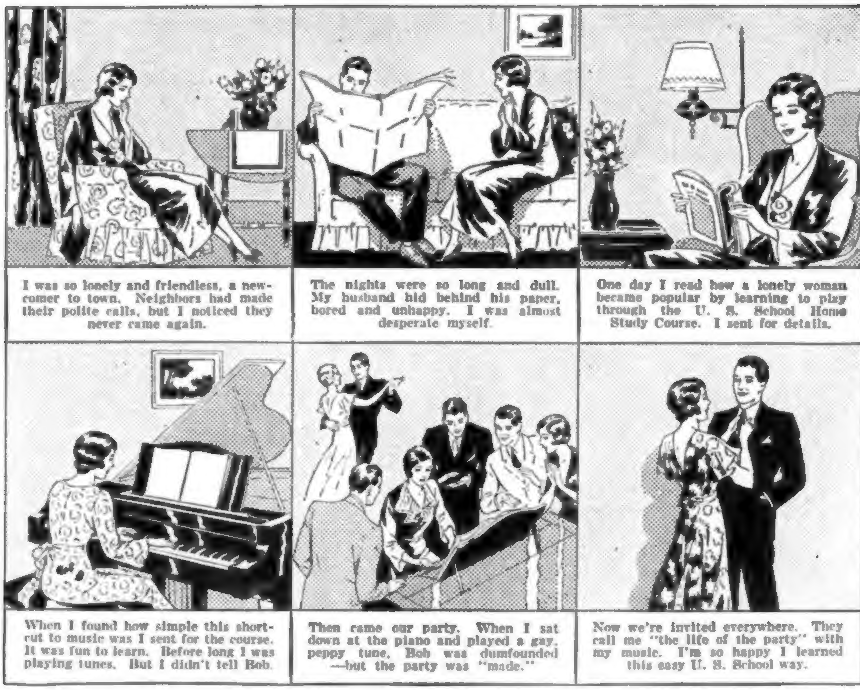
(See "Foresight" p. 150; "Control Sex Force by Food," p. 31; "No Mucus, Head Clear," p. 154.)



I was so lonely and friendless, a newcomer to town. Neighbors had made their polite calls, but I noticed they never came again.

The nights were so long and dull. My husband hid behind his paper, bored and unhappy. I was almost desperate myself.

One day I read how a lonely woman became popular by learning to play through the U. S. School Home Study Course. I sent for details.

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Address .....

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There were 538 sets of blueprints sold on the auto camping trailer designed by Dick Cole. Here is one of them, built right to the letter of the plans by Wellington Smith, of Fort Frances, Ontario. Here shown the trailer is encamped in the wilderness near Banff, having made thousands of miles last season.

Andy's Shop Mail Box

The frost is on the punkin', and the corn is in the shock. That means Andy will have to be caught and shod before the frost hits the hangar, but the old boy is still one jump ahead of the gang. Read an' see!

THIS humble scribe does not know and in the words of John Chinaman does not care but it seems that the only enduring things that a magazine like this carries are the how to build it stuff.

Now I may be lifting myself by my own bootstraps and contradicting a lot of the work the boys go to here, but reason and "show up" logic alone lead me to think that the dope youse gents really goes fer is the material which exhibits the products of the planning minds of others—the how to build articles. Am I right or am I wrong?

At least we nevah heah of the featuh stuff in these climes and over this desk, and it does seem that a preponderence of evidence points to the fact that the most useful items are concernin' the buildin' matter, suh, and heah's why:

Every worthwhile letter that reaches me has a buzz about this or that article, and the last two months have shown nothing mentioned about the really hot features that our legmen in all parts of the world are working to give to you.

That may be purely personal piffle, and I may get the deuce for saying it. But I take a gamin's delight in getting out my say before I get my mouth shut.

Now before I get popped on the conk by the Old Man of the sheet, the estimable Donaldo G. Coolio, (he roars around like a Boolio) I'm gonna git about the business of working off the fever that crosses my brow and tell you something about the pix we have to offer you this month. Really a prize and interesting cargo.

Take the letter about the bungalow trailer which appeared in May. One comes from Wellington Smith, and he sends a pix which graces the head of this month's column. So you can actually see what a nice job this roaming bungalow is. We also got another letter from a feller who was a purchaser of one of the 538 sets of blurprints we sold on this riggin', saying as how since he lived in Maine, our trailer sure stood up an' took it. He went from Maine 10,000 miles around the kentry this last season and when out in the middle of the Petrified Forest of Arizona, he met up with another trail chariot of the same parentage, built from MM & I plans. Here's the buzz:

Dover-Foxcroft, Me.

Gentlemen:

You may be interested to know that I traveled 10,000 miles this summer with a trailer made after plans published in the May issue of "Modern Mechanix and Inventions Magazine." We also met an exact dupliente, made from the same plans, out in the middle of the Petrified Forest. It worked very well and allowed us to take a great trip. As far as we can see it is in just as good condition as when we started.

Yours truly,
ALFRED J. FORTIER.

Another of our designs which has delighted hundreds and given sport to many is Sam Rabl's design of "Tubby" which appeared in the May issue.

(Continued on page 14)

June 11, 1932

"Just a week ago, I made application for a new position, and was successful. It gives me an increase in salary, saves commuting daily, and increases my responsibility."

C. T. B.

February 29, 1932

"Tonight I was told that tomorrow I will become the General Manager—also that although business is not very good, I am to have a substantial increase in salary. Incidentally, I was one of three in the entire organization who did not suffer a reduction in salary last year."

C. L. M.

May 10, 1932

"Today, just ten months after beginning your training, I am receiving 50 per cent more salary than when I started. Your instructions on figuring depreciation saved my firm $1800."

H. L. B.

April 18, 1932

"During the 13 months since I enrolled with you, my salary is considerably larger than when I enrolled, although nearly every local firm has cut salaries from 10 to 40 per cent. Your training has helped me to revamp our accounting system to the mutual advantage of the firm and myself."

H. W. W.

April 9, 1932

"I have been rewarded with promotion twice during this depression and my latest promotion more than paid for the cost of the training. Many of the boys with whom I formerly worked are now unemployed."

J. S. Mc.

March 17, 1932

"On Christmas Eve, my employer gave me an unsolicited raise—this despite the fact that many are getting cuts. My income has increased more than 100 per cent in the last three years."

J. B.

June 6, 1932

"Since starting my training in 1929, I have had several promotions but the one about which I am really proud happened this spring. With it came over a 100% increase in salary."

J. M. G.

Pay Raises? Yes—Today!!

—read and see what's happening to ambitious men.

To the average man—the fellow who's wondering whether he can even hold his job—the idea of another man getting a salary increase now sounds like a fairy tale.

But it isn't fiction—it's fact—registered in larger pay checks and fatter savings accounts of real men who have made progress when others were standing still—or falling back.

There's a reason for this progress. It isn't the result of wishing or wanting or worrying or waiting. It's the reward of the right plan properly executed.

Look here—the employer today demands exceptional men—men who can bring in more business, or cut costs, or improve the service, or otherwise help the firm right now. That takes more knowledge—greater ability. And the quickest, surest way of building one's knowledge and ability is by training.

As the result of LaSalle training, thousands of men have held their jobs, kept their salaries intact right in these times, while others were taking cuts or being let out entirely. And some men have gone ahead, have won promotions and raises—even in this depression.

Out of our current files we've put together a hundred reports of pay raises and promotions received during the last twelve months or so—your inquiry will bring "100 Pay Raises"—made by men like yourself.

Read what these men say—NOTE THE DATES—these are not records made in the easy money years of '27 and '28 and '29—*they're right in the hard sledding years—in '31 and '32.*

Now—read the few samples in the column at the left—NOTE THE DATES!

Every day you wait spells possible loss. Find out so you can judge for yourself. Get the facts.

Remember—it wasn't the men—it was their training that brought promotion.

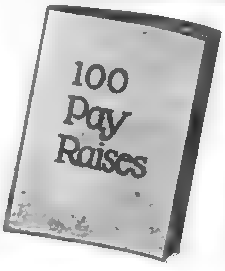
If you're ambitious and will work, you may do the same by training. You can't lose, and you may gain—big.

But first—you *must* investigate.

Check the coupon and send it right now—before you forget and regret.

LA SALLE EXTENSION UNIVERSITY, Dept. 12493-R

I'd like to see those "100 Pay Raises" and have full information about your salary-raising plan of training in the business field I have named. I understand you will send these without any cost or obligation to me



Name.....

Address.....

Present Position.....

Field of Business.....

LaSalle Extension University

How to obtain a PATENT

Reasonable Fees and Convenient Terms

I have served thousands of inventors in all parts of the United States and I am able to serve you very reasonably and extend liberal terms of payment. So don't waste valuable time.

Small Ideas May Have Large Commercial Possibilities

Delays are Dangerous in Patent Matters

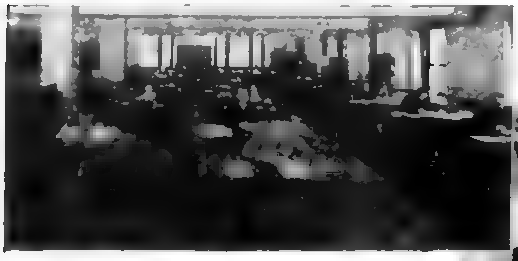
THE FREE BOOK shown here was prepared for inventors, to show them exactly what steps they must take to secure a PATENT. If you have an idea, you should send for this book AT ONCE. It will tell you exactly how an application for a Patent is made, what information you must furnish your attorney, and what steps he must take in order to protect your interests. Remember, inventing an article is one thing—securing the exclusive right to manufacture it, use it or sell it is another. Without a U. S. Patent, you cannot expect to reap the profits that your invention may make possible. Send at once for this book. After you get that, you'll know exactly what to do to protect yourself.

I Serve You Quickly and Secretly

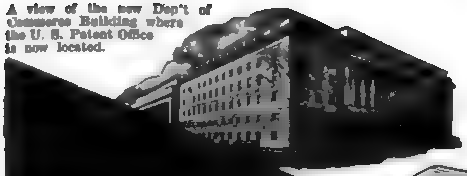
Anything you write me or send me is strictly confidential between us. All letters and drawings are kept in strong, steel, fire-proof files, which are open only to myself or authorized members of my staff. I have secured patents for inventors located in every state in the Union. My organization is a large and efficient one. My practice is confined entirely to Patents, Trademarks and Copyrights. I have had years of experience in Patent Matters. When you place your ideas in my hands, I am in position to proceed at once to secure protection for you. My fees are reasonable, and, if you desire, I can arrange convenient terms of payment.

My Location in Washington

My offices in Washington are convenient to the Patent Office, and I and my assistants can, therefore, appear promptly before the officials and Examiners.



- Above is a view of my drafting and specification rooms where a large staff of experts is in my constant employ.
- The photo at the right shows a section of my large filing department. All disclosures from clients are held in the strictest confidence in strong, steel files.

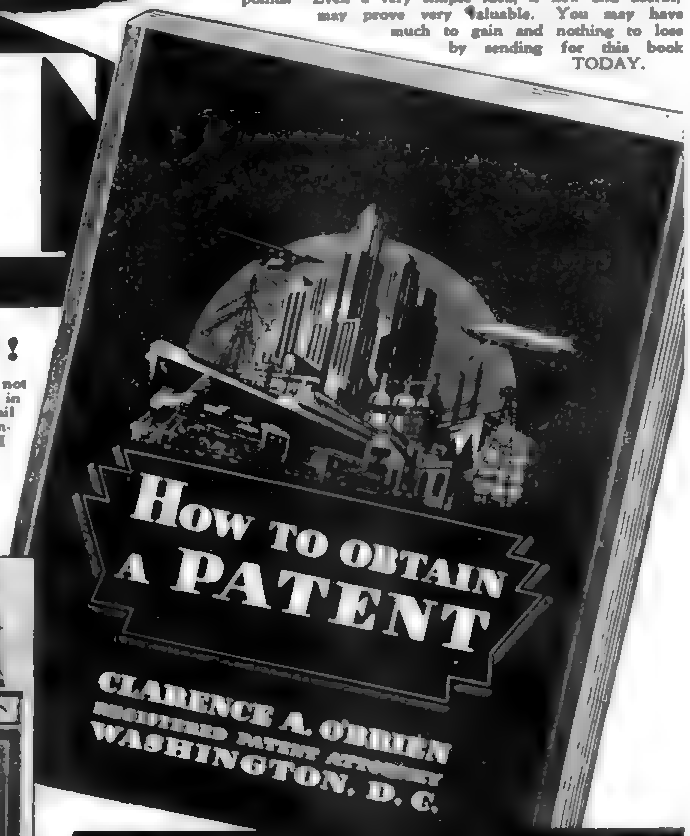


A view of the new Dep't of Commerce Building where the U. S. Patent Office is now located.

NT

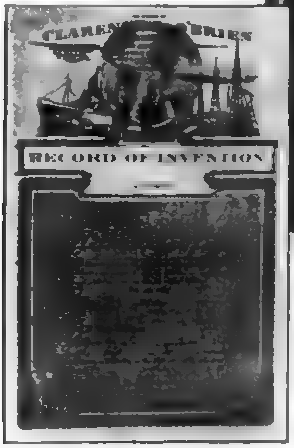
This Book tells:

How your Patent Application is made; what kind of sketches or drawings are necessary; what other papers must be made out; how the Patent Laws protect you; why it is important to avoid loss of time in getting your application filed; and many other important points. Even a very simple idea, if new and useful, may prove very valuable. You may have much to gain and nothing to lose by sending for this book TODAY.



IMPORTANT!

Please understand that you are not under the slightest obligation in sending for this book. I will mail it, together with the Record of Invention form, the same day I receive your request. Use the coupon below to save yourself time and trouble. After that, you will be in position to proceed or not as you choose, to make your application for a patent.



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REGISTERED PATENT ATTORNEY
WASHINGTON, D. C.

CLARENCE A. O'BRIEN,
Registered Patent Attorney,
317-T, Adams Bldg., Washington, D. C.

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(Be sure to write or print name clearly.)

What will you be doing one year from today?

Three hundred and sixty-five days from now—what?

Will you still be struggling along in the same old job at the same old salary—worried about the future—never quite able to make both ends meet?

One year from today will you still be putting off your start toward success—thrilled with ambition one moment and then cold the next—delaying, waiting, fiddling away the precious hours that will never come again?

Don't do it, man—don't do it.

There is no greater tragedy in the world than that of a man who stays in the rut all his life, when with just a little effort he could advance

Make up your mind today that you're going to train yourself to do some one thing well. Choose the work you like best in the list below, mark an X beside it, and without cost or obligation, at least get the full story of what the I. C. S. can do for you.

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Occupation .....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

ANDY'S SHOP MAIL BOX

(Continued from page 10)

We have heard of and seen shots of Tubbies from one end of the globe to the other, and here's a letter from another fan who has built one.

Montreal, Can.

Dear Sir:

I am enclosing two snaps of "Tubby," having followed the plans etc. in M M. I have received the utmost satisfaction from her, and I wish to congratulate the author of the article. The only changes that I made were: I put a small deck at the for'rd end of the craft and built a small locker under it (see photo). Instead of using lee-boards I built a 6" skeg. the length of the boat. Again congrat's,

ROBERT ALLEN, JR.

Here's a Tubby from Montreal. Nearly a hundred of these boats have been built.

Another ingenious duck sends us shots of a Ford sawing rig he cooked up—don't think it was from plans ever published anywhere. Here we go:

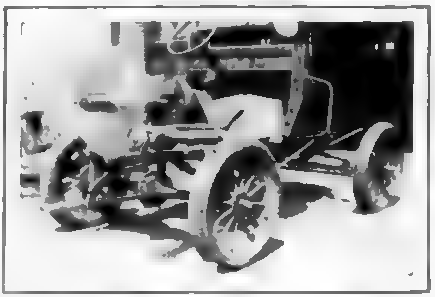
Dear Andy:

Enclosed you'll find two photos of a cut down Ford, converted into a saw or emery wheel. It can also be used for a portable power plant wherever you use belting. Briefly, it's a cut down frame with the pieces left over, welded, to make a frame for the shafting. The fork you see in the picture, above the right rear wheel, is used to support the logs. This fork fastens to the rod, which is located at the side of the left rear tire. The emery wheel is used in place of the saw when needed.

Hoping you'll be able to use this, I remain,

Sincerely yours,

GEORGE E. ANDERSEN.



"Let the Ford saw the knots," says George E. Andersen, and here's what he does it with. The job can saw an eight-inch log with the motor idling.

(Continued on page 16)

FREE

The Road to Understanding *For Men Past 40!*

WHY is 40 the "dread age" for many men? What is the "intimate" disorder that often robs them of vitality, health, joy of living? This daring free book answers these and other vital questions. Mail the coupon for your Free Copy.

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MANY men mistake these dangerous and distressing ailments for approaching old age and live lives of misery, when by simply restimulating a tiny gland—called the prostate—they might be enjoying vim and health. Already 100,000 men have tested the merits of a new drugless method of gland stimulation perfected by a scientist with offices in Ohio, California and Canada. Now many physicians, specialists, hospitals and sanitariums use and endorse it, for prostate gland failure. It is not a medicine, drug, massage, diet, exercise or violet ray. Its relief is not only usually quick—but lasting. Many users say it cleared up their distressing symptoms and made them feel 10 years younger in 7 days. Now it will be sent to you on a guarantee that if it doesn't do the same for you, pay nothing. If you want to know the joy of living, mail the coupon for your Free copy of "Why Many Men Are Old at 40."

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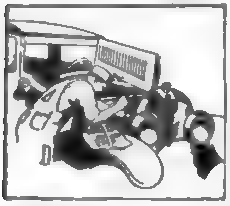

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ANDY'S SHOP MAIL BOX

(Continued from page 14)

P. S. It will cut an eight-inch log with the motor idling.

An eight-inch log with the motor idling? Sez you, Andy. Try it in my nightshirt. But you may be right.

Here's from a guy you've seen so much of it gives me a pain to publish the letter.

Dear Andy:

Some time ago I sent you snaps of the trailer I built from the plans in your last May issue, and say, I just returned from the West and I wish to say the trailer is a dandy, and talk about camping comfort! Oh, it's a pleasure to let it rain for we're high and dry.

I was just wondering if you received the other snaps I sent you. Anyhow, here is one taken in the tourist camp at Virden, Manitoba, one of the many beauty spots of western Canada.

Next time I come to Minneapolis I'll show it to you.

Yours sincerely,
WELLINGTON SMITH.

Ovila Turgeon, of Attleboro, Mass., built this remodeled Ford using our Speedster body plans.

Now come the Ford Speedster bugs, deposing and saying as follows:

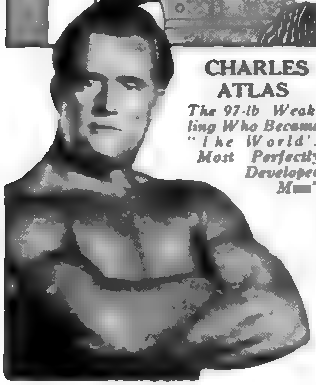
Dear Andy:

I am taking great pleasure in writing to you for the first time. I am enclosing a snapshot of the M M Speedster body I built that was in your mag a few months ago. I have timed it and it does from 45 to 48 miles per hour. It was so light in fact, that I put a few sand bags in the back and it just goes neat. Instead of putting in fabrikoid I got a couple second-hand leather auto tops on it for which I got dirt cheap—50c.

What I'm mostly interested in is the Sky Scout airplane designed by Mr. Pietenpol. I would like to know if you would send me the May and June editions of the 1932 M M, for I have the April one. If you can't supply me, Andy, would you mind getting someone of the hangar gang to supply me, and will you also mail C.O.D. I received the 1932 Flying and Glider Mag and boy, it's neat. If I am able to have the chance I would appreciate very much to see you and the others. I would either go by a home-made air buggy or by machine. Hoping my letter is successful,
Yours truly,
OVILA TURGEON.

(Continued on page 18)

THE BATTLE FOUGHT IN BED THAT MADE FRED A HE-MAN!



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City ..... State .....

ANDY'S SHOP MAIL BOX

(Continued from page 16)

P. S. I wouldn't mind hearing from anybody who has built the Air Camper or Sky Scout. Your column is great. Keep it up.

There's a thrill to building a boat that no other sport can match, unless it is the building and test flying of your own airplane.

This little bus, Tar Baby, was a popular little critter. We have one coming up that is a bit larger, yet which is very small, and is called "All Sorts." She can be used with an outboard, or can be sailed, or will serve as a dinghy, or inboard motor boat, or she can be sailed on the ice as an ice boat.

Watch for her!

You who loved Tar Baby will like to hear from this man who has built her:

Milwaukee, Wisconsin.

Dear Andy:

A short time ago I asked for a little sailboat that would be easy and cheaply made. A few months later "Tubby" appeared in your mag and I have just finished launching it, took me about a week of steady work but when she was in the drink it was worth all the work ever put into it. Tubby is the fastest sailboat on the lake. I put a deck and keel on her instead of leeboards, and she's the sweetest sailboat I have ever seen. Tubby cost me about $15.00 complete, but I would not sell her for $50.00.

I have been reading M M for about two years and think there is no other like it, "I mean no other as good!" Enclosed find picture of boat and myself, the thin fellow is my cousin but don't mind him.

If you can find room in your mag, please put a picture in for the gang to gaze at. I

Here's a Tar Baby built by a Milwaukee M-M'er. Ray Stahnke (builder) says she's a honey and he had a whale of a lot of fun building the little job.

(Continued on page 20)

Would $3500.00 help You..why?

I WILL PAY $250.00

For the Winning Answer to This Question!

I am going to give $3,500.00 to some deserving man or woman who answers my announcements. In fact, I will make someone supremely happy, just as I did when I sent Joe Walsh, a young Polish coal miner, our certified check for $3,500.00. He was given an opportunity and he took advantage of it. Now YOU have an opportunity to win $250.00 by merely writing a few words. Just answer my question—Tell me in 25 words or less how $3,500.00 would help you, and why—nothing more for you to do for this $250.00 Cash Prize! The first answer that comes to your mind right now may win. Think how $3,500.00 would help you.

..then Write me today!

No matter how plain or simple your answer may appear to you, be sure to send right away—it may win—who knows? There is nothing more to do to win $250.00 — no "if's" or "and's" — $250.00 will absolutely be paid for the winning answer.

25 SIMPLE WORDS WIN $250.00

Rush me your answer today. Send no money—just tell me how $3,500.00 will help you. Send your answer by letter or on a postal card — or use the [redacted] but by all means be sure to send it at once.

FOLLOW THESE RULES: $250.00 Cash will be paid for the answer that, in the opinion of the judges, best answers this question — "Why would $3,500.00 Cash help you ... why?" Send your answer in 25 words or less if possible. All answers must be postmarked on or before March 1, 1933. Neatness or spelling do not count. You must be 16 years of age or over. Only one answer will be accepted from a family. Just mail your answer promptly. Duplicate prizes will be awarded in case of ties. All replies become the property of Tom Wood, Manager.

HOW TO GET $100.00 CASH CERTIFICATE

I am so anxious to receive your prompt reply that I will make it worth while to rush the answer to me. Be sure your answer is mailed within 3 days after you read this announcement—sooner, if possible—so I can send a Certificate for promptness, which guarantees to pay $100.00 Cash Extra to the winner

Sending Your Answer to My Question Promptly Qualifies You for Opportunity to

WIN $3,500.00 CASH

Or Studebaker 8 Sedan and $2,000.00 Cash

This marvelous prize is extra and separate from the $250.00 Cash Prize offered for the winning answer. Think what this sum of ready cash would mean to you—yours, to spend as you like—no strings on it whatever—just YOUR money! It is easy to qualify for this opportunity to win—here is your chance. Grasp it. Send me your answer in 25 words or less. Just answer this question, "Why would $3,500.00 Cash help you?" Send it today

BE PROMPT, for I want your answer to this question before sending my generous plan of distributing $6,000.00 in Cash and in which I guarantee to pay $3,500.00 in Cash to some deserving person, $1,000.00 to another, $500.00 to another, and so on until my grand prizes have been distributed

TOM WOOD, *Manager*
Dept. M-203-P
H. O. Building Cincinnati, Ohio

A COUPON LIKE THIS BROUGHT HIM $250.00

A. L. Teeters of Memphis, Tenn., won $250.00 Cash just by sending an answer to a question like this. His investment to win all this money was one single two-cent stamp. Will you invest postage for such an opportunity? It need cost you only one single penny if you paste the coupon with your answer on a penny postal card. Do this and mail it today!

• • •

Your Character Analyzed From Your Handwriting

All answers will be submitted to M. N. Bunker of the American Institute of Graphic Analysis, who will send to everyone a short analysis made from their handwriting. You will be amused—perhaps amazed at what it tells you of your talents and possibilities. You will also receive FREE a chart such as Dr. Bunker uses and by which you may analyze your friends' handwriting too. You'll be pleased and surprised.

MAIL TODAY

TOM WOOD, *Manager*,
Dept. M-203-P, H. O. Bldg., Cincinnati, O.

Here's my answer to "Why Would $3,500.00 Cash Help You . . . Why?" .....

.....

.....

.....

My name is .....

Address .....

Town ..... State .....

Date I read your offer. .....

I am to receive FREE a brief character analysis from my handwriting and a FREE Character Analysis Chart.

WANT A STEADY JOB?

TRAVEL for "UNCLE SAM"

MANY OTHER U. S. GOVERNMENT POSITIONS

STEADY WORK

MEN—BOYS 18 TO 50

Short Hours — Pleasant Work
Rapid Advancement — Permanent Employment

HUNDREDS POST-DEPRESSION LIFE JOBS COMING

MAIL COUPON NOW. ACT AT ONCE.

VALUABLE COUPON

FRANKLIN INSTITUTE, Dept. C313, Rochester, N. Y.
Rush to me entirely free of charge: 32 page book, with list of U. S. Government Post Depression Life Jobs and particulars telling how to get the job here checked.

...Railway Postal Clerk	[illegible]
...Post Office Clerk	[illegible]
...City Mail Carrier	($1700-$2100)
...Rural Mail Carrier	($2100-$[illegible]
...Inspector of Customs	($2100-$3000)
...Immigrant Inspector	($2100-$3000)

(This year 1 month off, no pay)

Name.....

Address.....

Dirt Track Racing

Now you can break into the racing game. How to build your racer, contest rules, superchargers, balances, speed, "revs," compression ratios—a complete racing treatise illustrated. Postpaid $1.

RAY KUNS, Dept. A, Madisonville, Cincinnati, Ohio.

MOULDS TO CAST

Lead Soldiers, Indians, Trappers, Hunters, Wild and Farm Animals, 239 different Moulds to select from, casting true to life models. Easy and inexpensive to make. Send 5c Stamp for illustrated Catalogue.

HENRY SCHIERCKE, Dept. D, GHENT, N. Y.

No. 4 Issue of the
Mechanical Package Magazine
Will soon hit the news stands—
Watch for it!

BASHFUL?

"Stamp on You!" Are you nervous, embarrassed, or ill at ease? Stop being shy of strangers. Conquer blushing and the terrible fear of your superiors. Be cheerful and confident! Your faults easily overcome so you can enjoy life to the fullest. Send 25 cents for my book, "Backfulness," containing full particulars.

RICHARD BLACKSTONE, B-2312 Flatiron Bldg., N. Y. CITY

ANDY'S SHOP MAIL BOX

(Continued from page 18)

will be glad to answer any questions regarding the rig or deck or keel I used if a self-stamped and addressed envelope is sent to me. This is the first boat I have ever made but have had fine success, thanks to M M.

"So long Andy,"

R. STAHNKE

Some facetious editor wrote about frost being on the pumpkins when he headed my column this issue. Well, the frost as well as no little amount of ice will be on the lakes when you get this mag, so what about an air car? You observe I have nothing up my sleeves, on account of I have no sleeves. And with winter so near!

Here y' are:

Cape Charles, Va.

Dear Andy:

Just about a year ago I bought my first copy of the M M. It was great I thought—still do. What I liked about it was the department run by yourself (and the grease monk!).

Well, this little mag just seemed to start my hands itching to do sompin' like the other boys was all writing in about, so here's what happened—and a picture of "it."

The chassis is the remains of a Chevy, '30 model, that took afire. The motor is a Whippet,

(Continued on page 22)

New
[15 to 550 Meters]
16 TUBE
30 DAYS FREE TRIAL

ALL-WAVE RADIO Only $39.95

Completely Assembled with Large Dual Speakers

World Wide Reception may be yours when you own this sensational new Midwest 16-tube ALL-WAVE set with a tuning range of 15 to 550 meters. Hear standard U. S. broadcasts from coast to coast, listen to amateurs, police calls, airplane conversations, and, when conditions are favorable, short-wave broadcasts from England, Germany, France, Italy, South America, Australia, and other stations *all over the world.* You get the WHOLE WORLD OF RADIO when you get this new 16-tube Midwest—and you buy it at an amazingly low price direct from the big Midwest factory, on easy payments if you wish. No middlemen's profits to pay when you buy the Midwest way.

Don't be satisfied with less than a 16-tube MIDWEST ALL-WAVE set. A receiver covering only the regular broadcast waves is only *half a set.* Improvements in short-wave programs and receivers have made ordinary broadcast sets obsolete. The Midwest All Wave gives you everything that's good in radio, both at home and from abroad—and all in one single dial set with perfect tone and volume control and the marvelous new color-lite tuning and STAT OMIT.

Don't buy any radio until you get the big new Midwest catalog. Just sign and mail the coupon or send your name and address on a postal—NOW!

ALL THE NEW 1935 FEATURES

Stat-Omit Tuning Silencer . . . Class "B" Amplification . . . Color-Lite Wave Band Selector . . . Acoustically Matched Dual Speakers . . . Full Band Automatic Volume Control . . . Dual Power, Two Separate Transformers . . . Dual Ratio Dial . . . One Complete Chassis . . . Complete Scientific Shielding . . . 18 Tuned Circuits, 9 in Cascade . . . 15 to 550 Meter Tuning Range . . . Image Frequency Suppressor . . . Fractional Microvolt Sensitivity . . . Full-Floating Variable Condenser . . . Absolutely Faithful Tone Reproduction . . . Positive Tone Control . . . Thermal Safety Fuse . . . Duplex Duo-Diode Detection . . . New Type Tubes . . . Low Operating Cost.

TERMS as low as $5 DOWN

COMPLETE LINE OF CONSOLES

The big new Midwest catalog shows gorgeous line of artistic consoles in the new six-leg designs. Mail the coupon now. Get all the facts.

Deal Direct with Factory! SAVE UP TO 50%

Midwest sweeps aside the costly old-fashioned way of selling through distributors and dealers. You buy direct from the Midwest factory with just one small profit added. You save all of the middlemen's profits.

Investigate! Mail the coupon. Get the Midwest catalog. Learn the facts about Midwest 9, 12 and 16 tube ALL WAVE sets—also Battery sets and amazing new Radio Phonograph. Learn about our sensationally low factory prices, easy payment plan and positive guarantee of satisfaction or money back. Get a bigger, better, more powerful, better toned radio—at a positive saving of 30% to 50%!

MIDWEST RADIO CORP.
Dept. 154 [Est. 1920] CINCINNATI, OHIO

Read this letter!

"During the past week I logged the following FYA Pontoise, France, GBK Rugby, England, HVJ Vatican City, Italy, XDA Mexico City, VK-2ME Sydney, Australia, VE9GW Bowmanville, Canada, 12RO Rome, Italy, G5SW Chelmsford, England, CGA and VE9DR Drummondville, Canada. Also picked up many amateur and airport stations from all over United States. Numerous ship, shore and trans-Atlantic phones from both sides and an Hawaiian Test Station came in clear and sharp. Several Spanish and German speaking stations have also been received but not yet identified. Have received every broadcast from FYA, morning and afternoon. Or over a week with wonderful tone and volume. The Midwest set is certainly one to be proud of." Wm. S. Teter, Winterpark, Florida

RUSH THIS COUPON FOR AMAZING FREE TRIAL OFFER AND BIG BEAUTIFUL CATALOG

Midwest Radio Corp., Dept. 154, Cincinnati, Ohio

Without obligation on my part send me your new 1943 catalog, and complete details of your liberal 30 day free trial offer. This is NOT an order.

Name . . . . . .

Address . . . . . .

Town . . . . . State . . . . . .

USER AGENTS Easy EXTRA MONEY! Check here for details. ☐

Come to Los Angeles

4 full courses *at price of single course*

Save money by enrolling in National Now. For single tuition fee, we now offer the four complete radio, electrical, television-talking picture and broadcasting courses. Four courses for price of one.

LEARN TELEVISION · RADIO
ELECTRICITY-TALKING PICTURES and BROADCASTING

A bargain *offer!* No longer is it necessary to pay several tuitions. Now, for the first time in history, *National* offers complete training in Radio, Electricity, Television Talking Pictures and Broadcasting all at single tuition fee for one course. When you enroll at *National*, these four full and unlimited courses of training will be given, enabling you to qualify for good jobs.

NO EXTRA EQUIPMENT

Thousands of dollars worth of latest equipment newly installed for you to work on. Qualify for U. S. Govt. examination. We award a life scholarship and help you to get a job that will start you on the road to BIG PAY and independence for the rest of your life (individual, practical instruction. Right NOW, while jobs are impossible to "land" by the untrained man, you can get *Training* for the lowest tuition fee ever offered. This is a limited offer, but you must act NOW!

ELECTRICITY

Become an electrical expert. Complete electrical machinery and equipment for you to work on at National.

COME TO LOS ANGELES—the center of radio and electricity—and where the great American television laboratories are located—where hundreds of trained sound engineers and mechanics are employed in talking picture studios.

LARGEST and OLDEST TRADE SCHOOL in WEST

For 27 years *National* has successfully trained men by practical shop methods. Previous education unnecessary. More than 25,000 graduates.

TELEVISION

The newest trade, with a tremendous future. Latest scanning disc equipment. National pioneers in this interesting work.

Railroad Fare Allowed to L. A.

For a limited time we will allow each railroad fare to Los Angeles from any point in the United States. This is deducted from tuition, so the trip costs [redacted]

FREE EMPLOYMENT SERVICE

Spare time jobs while at school. We help you get a job to pay living expenses while learning. Our unlimited *employment service* will help you get a JOB after you graduate. Four delightful months of training and you are qualified.

TALKING PICTURES

10,000 theaters equipped for sound. Good pay. National-trained men preferred in studios and theaters.

NATIONAL RADIO & ELECTRICAL SCHOOL
Including Television, Talking Pictures & Broadcasting
Dept. 123E, 4006 S. Figueroa, Los Angeles, Cal.

—MAIL THIS COUPON FOR FREE DETAILS—

This coupon will bring you our big, free training book if you are interested. It gives full details of the 4 big courses—radio, electrical, television talking pictures and broadcasting; also details about railroad fare offer and plan to earn living while learning.

Name.....

Address.....

Town..... *State*.....

ANDY'S SHOP MAIL BOX

(Continued from page 20)

This fine looking little *air car* is built out of the remains of a '30 Chevrolet and an old Whippet. Jack McMath built her.

'29 model, was almost new when I got it. The prop is 4½ feet with brass tips.

The "draft wagon," as I call it, in a dead calm will do an even 60-65 without the headlights. And I get better than twenty miles on a gal, unless running against a strong head wind. Boy! what that thing won't do, with a strong tail wind, like we get, here, sometimes. I've been on several long trips in it—4 or 5-hour drive from home.

The boys around here have all gone in for the Pack Mag. The midget car stuff is what got 'em I think. I didn't intend writing a book, so, I'm

JACK McMATH.

P. S. The ads on the sides were a wrinkle to get some free gas. Very prominently displayed, is a portion of the Chesapeake Bay.

WANT TO STOP TOBACCO?

Banish the craving for tobacco as thousands have. Make yourself free and happy with Tobacco Redeemer. Not a substitute, not habit forming. Write for free booklet telling of injurious effect of tobacco and dependable, easy way to relieve the craving many men have.

Newell Pharmacal Co.
Dept. 867, Clayton, Mo.

FREE BOOK

NERVES?

Are you always Excited? Fatigued? Worried? Gloomy? Bashful? Pessimistic? Constipation, indigestion, sleeplessness, cold sweats and dizzy spells are very often caused by **NERVE EXHAUSTION.** Drugs, tonics, exercises and medicine cannot always help weak sick nerves! *Learn how to regain Vigor, Health and Calmness.* Send 25c for my book **"How Nerves Per Old,"** containing full particulars.
(RICHARD BLACKSTONE, N-3312 Fulton Bldg., N. Y. C.

BECOME AN EXPERT

ACCOUNTANT

Executive Accountants and C. P. A.'s earn $3,000 to $15,000 a year. Thousands of firms need them. Only 12,000 Certified Public Accountants in the United States. We train you thoroly at home in spare time for C.P.A. examinations or executive accounting positions. Previous experience unnecessary. Training under the personal supervision of William B. Castenholz, A. M., C.P.A., and a large staff of C. P. A. members of the American Institute of Accountants. Write for free book, "Accountancy, the Profession that Pays."

LaSalle Extension University, Dept. 1240-H Chicago
The School That Has Trained Over 1,100 C. P. A.'s

SMASHING PRICE REDUCTION

on Automatic, Motor-Powered LACO!

OIL HEAT Cheaper than COAL

was $120 -NOW, only $58.25 NET WHOLESALE PRICE

NOT a Gravity Burner. —Powered with Genuine Westinghouse Motor!

Identically the Same Great

LACO Burner that sold for $120. (Over 30,000 in use)

SENSATIONAL OFFER! For the balance of the season, this $120.00 Powered Automatic LACO Oil Burner, with the famous patented Mineral Wick—guaranteed for 25 years—is yours for ONLY $58.25, Net, Wholesale Price!

THINK OF IT! A thoroughly high quality Power Burner, complete with automatic room temperature controls and all fittings, fuel tank (full of oil)—all installed and ready to operate—for LESS THAN $100! Dealers, Agents: try it right in your own home for 30 days. FREE—then, you'll know it's the burner you want to handle.

Remember, this is NOT a cheap gravity burner. It's the genuine Automatic, Westinghouse-Powered LACO with all its patented features.

START NOW—TRY IT AT OUR RISK!

You'll never have a chance like this again! The $58.25 net price holds only THIS year. By all means, START NOW! This amazing low price is made possible by huge mass factory production. LACO sales are now ahead of 134 other makes. We are now the world's largest exclusive oil burner manufacturer! Buying materials in immense quantities for cash we make enormous savings. OUR REPRESENTATIVES GET THE ADVANTAGE!

Write for free booklets complete list of New Low Net Wholesale Prices. Give size of home, type heating plant. SEND NOW!

MINERAL WICK Burns Oil New Way

MINERAL WICK—patented feature to be had only in LACO—makes Oil Heat actually Cheaper Than Coal! Oil rises up through red-hot porous Mineral Wick turns to hydro carbon gas most perfect fuel known to science. Only 4 per cent GAS [illegible] per cent AIR produces clean, smokeless flame of intense heat! No waste smoke, soot or grease.

No electric ignition! Safer than gas range. Listed Standard by Underwriters Lab. Practically noiseless.

Goes right into any heating system, instantly, without change.

30 DAYS TRIAL OFFER!

Try it FREE in your own home. Then, you'll surely want to be our representative. Make Big Money. Get Free Booklets. New Low Wholesale Prices. Free Burner Offer. SEND NOW!

DEALERS, AGENTS

Sensational FREE BURNER offer starts you out! Make $500 to $1000 a mo. without experience. Every home interested in guaranteed LACO at Amazing New Low Prices. 26 models and sizes suit every need. Valuable factory help given. Start NOW. Try a LACO in your home at Amazing New Low Price at our risk. Don't wait. SEND NAME TODAY!

LACO OIL BURNER CO., 2122 Union Ave., Griswold, Iowa

McSweeny's Easy Way to a New Job at Big Pay—

J. H. McSWEENY

McSweeny Training makes you independent of hard times. There always is a demand for trained men. McSweeny teaches trades that never will be replaced by mechanical equipment. Easily and quickly you learn all about Automotive Mechanics and General Electricity. Never was opportunity greater for the man who knows how.

Eight to Twelve Weeks—Then

a job that should pay from $35 to $70 a week, in the automotive or electrical field. Get out of the low-pay class before electricity takes your job.

No Books—No Lessons

In my shops we use tools instead of books. Students work on live equipment. Fifty thousand men can attest to the advantage of having my practical training.

Guarantee of Satisfaction

I agree to train you until you are permanently placed in a good job at good pay if you are over sixteen years of age.

ELECTRICITY

Learn to control, master and apply that magical juice which rules the universe. Be a McSweeny Trained electrical man.

AUTOMOTIVE

Every motor propelled vehicle—automobile truck tractor—requires constant service. The fewer cars sold, the more service required.

Not a Correspondence Course—No Books—No Lessons

McSWEENY SCHOOLS

ELECTRICAL AUTOMOTIVE

Dept. C-11-12 CLEVELAND, OHIO

Mail This Coupon for FREE Book

J. H. McSweeny, Pres.,
Dept. C-11-12, 1815 East 24th Street, Cleveland, Ohio.

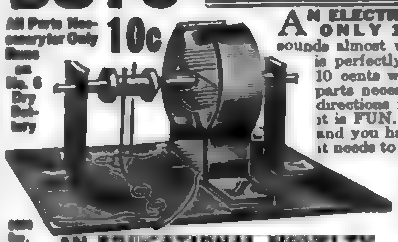
Without cost or obligation, send me your big FREE book and full details of your special tuition offer. (Check school interested in.) ☐ Electrical. ☐ Automotive.

Name .....

[illegible] .....

Town ..... State..... Age.....

BOYS BUILD THIS ELECTRIC MOTOR 10c



AN ELECTRIC MOTOR FOR ONLY 10 CENTS. It sounds almost unbelievable but it is perfectly true. For ONLY 10 cents we send you all the parts necessary, packed in a neat box, together with full printed and illustrated directions for assembling. No trouble at all putting the parts together, in fact it is FUN. Just follow a few simple instructions—it takes only a few moments—and you have your motor all ready to run. And OH BOY! Isn't it speedy! All it needs to run it is a No. 6 or similar dry battery. As to the fun you will get out of it, you won't have the motor an hour before you have it running and performing many novel and interesting experiments—has more power than you'd think. Besides, assembling the parts is an education in itself for any boy. Send 10c in any convenient form—stamps will do—and the motor will be sent you at once. Nothing more to pay—nothing more to buy.

JOHNSON SMITH & CO., Dept. 912, RACINE, WIS.

ONLY 10c Per Pair

Fighting Roosters

With very little practice you can make these exhibitors of Game Roosters imitate in the most lifelike manner the combativeness of a FIGHTING COCK-FIGHT. Well made, with jointed bodies. Pair 10c. 3 for 25c, postpaid.

GOOD LUCK RING

Very striking, quaint and uncommon. Silver finish, steel and ornamental design. Looks like some quaint ancient coin. Sent to any part of the world for only 10c postpaid. Send your finger size when ordering. Only 10c each.

Exploding Cigarettes

Box contains ten genuine cigarettes of excellent quality. They appear as regular but when smoked, the victim gets a very great surprise as one-third smoked, the victim gets a very great surprise as one-third of the cigarette with a BANG! A real mirth provoker yet entirely harmless. Prices 25c a box.

A Real Telephone. Works Indoors or Outdoors. 100 ft. or 1000 ft.

Though this is merely a very clever toy, it is quite as serviceable for short distances as the most elaborate apparatus made and it is much less liable to get out of order or to need adjustment, in fact it cannot be rendered ineffective and is very roughly handled. Can be installed in a minute "hook-up." Can be put to practical use from one room to another, up or down stairs, around corners, etc. The patented sounding disc transmit and receive the voice perfectly, making it a really practical talking telephone. Set consists of two phones, transmitting cord and full instructions. PRICE ONLY 98c per set postpaid. JOHNSON SMITH & CO.

MIDGET BIBLE

GREAT ECONOMICAL Pocket Bible in the World. Size of page 2½ x 3½ inches. Bible People, how to lead good lives to the end. A charming work of art. Must be seen to be appreciated. Make good money selling them to friends at only 10c each. PRICE 10c each. 3 for 25c, 12 for 75c, 100 for $7.50. Also obtainable in leather binding, with gold edges. Price 50c each, 3 for $1.25, 12 for $4, 100 for $30. Shipping Clerks for use with Midget Bible 10c

SERPENT'S EGGS

Just sprinkling 12 eggs. When in water a large, black coil gradually develops itself into a snake several feet long, which emits and writes about in a most lifelike manner. Price per box, 10c postpaid. 3 for 25c

STAGE MONEY

With a bunch of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. Prices, postpaid: 40 Bills 20c, 120 for 50c, or $3.50 thousand postpaid.

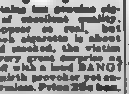
NOSE FLUTE

The Magic Nose Flute, or Heavenatone, is a unique and novel musical instrument that is played with nose and mouth combined. Consists of a little bunch in playing it which a few minutes required after a little practice to produce very sweet tunes that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of tunes with facility and ease.

Post Paid 10c

JOHNSON SMITH & CO.

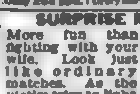
SURPRISE MATCHES



More fun than fighting with your wife. Look just like ordinary matches. As the victim tries to light one he gets quite a surprise. Price 10c per box, 3 boxes for 25c, 12 for 75 cents

10c

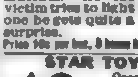
STAR TOY MAKER



Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, a Microscope, a Telegraph Instrument, Box Kite Talking Machine, Electric Microscope, Motor, Electric Door Bell, Water Wheel, Puzzle Nail, a pair of Stilts, Dog Sled, Sled Runners, Rabbit Yard, etc. 64 pages. 150 illustrations. PRICE 10c.

BOY'S OWN TOYMAKER. A new book. Tells how to make chemical toys, electrical toys, airgun toys, mechanical toys, paper toys, cardboard toys, boats, traps, etc. 300 illustrations. Price 25c postpaid.

FUN WITH MAGNETISM. 50 novel and unique experiments in MAGNETISM that you can perform with the aid of an ordinary magnet magnetic chain, floating and spinning needle, nail and ball of iron, magnetized top, motor, magnetic billiard balls, many other stunts. Also interesting information about lodestone, magnetism, electricity, etc. PRICE 10c p.p.d.



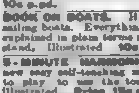
BOOK ON BOATS. How to build rowing sailing boats. Everything pertaining to boats explained in plain terms so anyone can understand. Illustrated. 10c p.p.d.

5-MINUTE HARMONICA COURSE. A new easy self-teaching method. Teaches how to play in any the tongue, tremolo, fully illustrated. Price 10c postpaid.

MONEY MAKING SECRETS. Golden opportunities for everyone. 64 page copyrighted book chock full of money-making ideas, recipes, formulas, wrinkles, trade secrets, etc. Documents that can be started with little or no capital at home or spare time. 10c postpaid.

TRICKS & MAGIC ENTERTAINER. Contains hundreds of tricks, jokes, humorous diversions that anyone can do. Also explains secret of second sight. Price 25c postpaid.

WONDERFUL X-RAY TUBE



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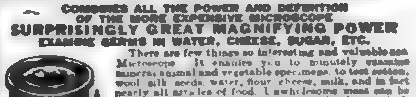

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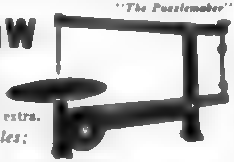

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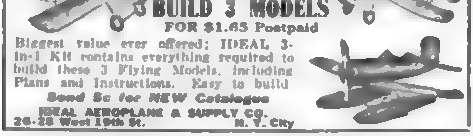

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(Continued from page 27)

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Of MODERN MECHANIX AND INVENTIONS, published monthly at Minneapolis, Minnesota, for Oct 1, 1932

State of Minnesota } ss
County of Hennepin }

Before me, a Notary Public in and for the State and County aforesaid, personally appeared W. M. Messenger, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the MODERN MECHANIX AND INVENTIONS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are

Publisher, Modern Mechanix Publishing Co., Minneapolis, Minn.
Editor, Donald G. Cooley, Minneapolis, Minn
Managing Editor, None
Business Manager, W. M. Messenger, Minneapolis, Minn.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

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Business Manager

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HIGH SPOTS in the 1933 Edition

Pietenpol Sky Scout—A one-place monoplane, designed by the man who built the famous Air Camper. The Sky Scout uses a Model T Ford motor, and the article not only tells you how to build the plane, but how to convert the Model T engine for airplane use. Of high-wing design, it is a smaller version of the Air Camper which performs admirably with this power plant.

Corben Cabin Monoplane—This is the famous "Baby Ace" design, turned out by Corben as a factory-built job. The cabin plane costs only $220 for materials, less motor! The Flying Manual article tells how to build the cabin plane, for which a Szekely or similar powered motor is recommended, and also an open model "Baby Ace" suited to Ford Model A motor, Cross Country Twin, Long Harlequin, or Henderson.

Hickman Baby Seaplane—Designed by Orville Hickman. This is the twin-pontoon biplane seaplane shown on the cover of the Flying Manual, reproduced on this page.

Gere Biplane—The neatest design of its type ever published. Single place, for Chevrolet or Ford motor. Resembles an army pursuit ship in flight. Original model now used by University of Minnesota for instruction of aeronautical engineers in principles of design.

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These are only a few of the items taken up fully in the 1933 Manual. Most of them are available in full-size blueprint form, too, for readers of the book. Better go to your news stand and get your copy **now**—the edition is limited!

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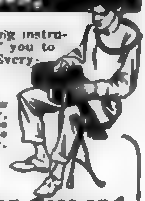

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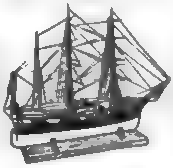

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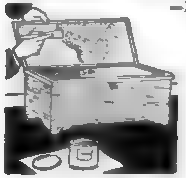

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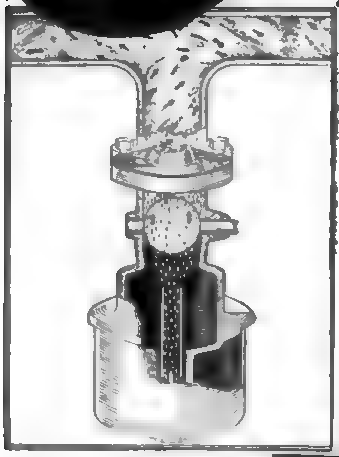

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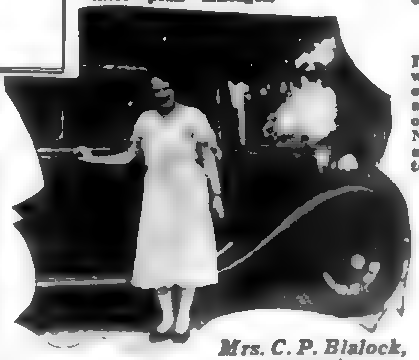

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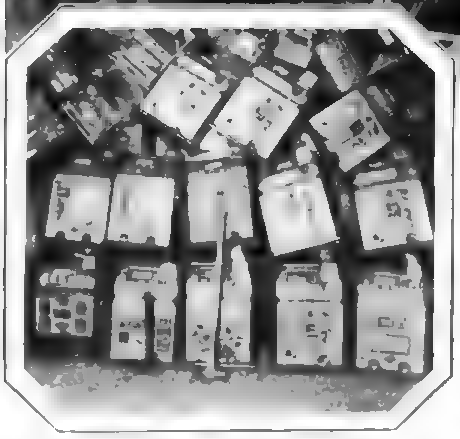
Machines that PICK Your

When a police official prepares to smash up slot machines seized in raids, an officer of the municipal treasury is always on hand to check in the coins disgorged by the devices.



Confiscated slot machines, ready for destruction after a police raid. Note the sledgehammers ready for action.

by WALTER A. RASCHICK

No matter how clever you are, you can't beat the slot machine racket. If you play the game, you'll have to reconcile yourself to seeing your nickels flowing away in a steady stream, paying tribute to the engineering brains which have designed these mechanical pick-pockets so efficiently that they can't fail to keep half or more of the coins fed into them, giving the player nothing in return except the thrill of seeing his money vanish.

"GOSH!" you've probably said more than once, as the symbols halted, hesitated, and then swung tantalizingly away from the center row, "I almost got the bells that time. Watch this one"—and out of your pocket and into the slot machine goes another hard-earned nickel.

Again the wheels whirr, and as their spinning dies into a metallic *clack-clack-clack*, the player stands pop-eyed before the entrancing mechanism: the plums align themselves in a row, but the middle one falls back out of line, and again there is no pay-off. Another nickel is played—and this time two cherries and a lemon click into place, and four five-cent coins of Uncle Sam's vast realm trickle down the pay-out slide and fall into the money cup at the front of the machine.

"Gosh!" you chortle, with a grin as big as all outdoors, "this is more fun than I've had in a blue moon"—and go right on throwing good money after bad.

Probably less than one person in 10,000 really knows anything about how slot machines work, how they are designed mechanically to extract money from the public's spacious pocket: and fewer than ten in a million really care.

Let us lift the shell off one of these mechanical pickpockets and see what makes it click to the tune of handsome profits—if robbery and profits can ethically be mentioned in the same breath.

50% of Symbols Are "Dead"

The most popular nickel slot machine in America carries the following symbols on its three reels: Gum, bell, plum, orange, cherry, lemon, and free play. Each of the three reels carries 20 symbols. The line-up of symbols on such a nickel machine selected at random, is reproduced on page 36.

This machine has been adjusted so that

POCKET — AND MAKE YOU LIKE IT!—*Inside Story of the Slot Machine Racket*

Most slot machines are set to deliver two nickels in every six trials—a mathematical ratio so infallible that it points only to the poorhouse for the man who plays consistently.

only every other symbol can stop in the pay-out row. Study the line-up carefully. Figure out for yourself how close, ostensibly, winning combinations come, while *actually* it is *totally impossible* for these combinations to register. Study this fascinating system closely—for it is a whole lot more economical to learn the lesson in print than it is to experiment with nickels.

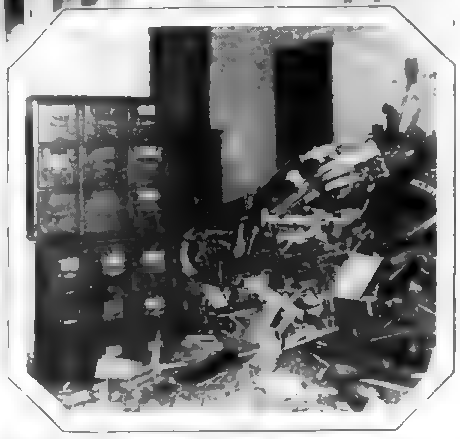
Paying Ratio Can Be Changed

It is easy to see from the chart that a free play cannot possibly be won (see 16th symbol, first reel); also, the premium of 12 nickels for three plums, or for two plums and a gum, cannot ever be achieved with the adjustment as given. For transient trade such an arrangement passes detection, but for a regular clientele, the operator changes the line-up occasionally, to avert suspicion. For the small cost of fifty cents, he can procure an extra reel strip, with the symbols arranged to his own choosing. He places this new strip on the first reel, which is the key to the whole system, and presto! "Free Play" will turn up in the winning row, and a veritable shower of plums—and lemons, too, if he orders it so—will result. Some operators change the strip on their first reel as often as once a week, to keep their steady trade happy (and unknowing).

You Can't Beat Mathematics

The machine we are describing is set on a 75-25 return basis. Out of every dollar played, approximately twenty-five cents remains in the machine. The standard schedule of "prizes" and the odds and returns on each set of symbols on the machine set 75-25 is shown on page 38.

Theoretically, out of every 1000 plays this machine will return 253 winning combinations, or a cash return of $38.40 out of every $50.00 played. This makes a theoretical cash return of $76.80 out of every $100.00 played—pretty close figuring on a transaction involving 2,000 nickels! and set to repay seventy-five cents out of every dollar played.



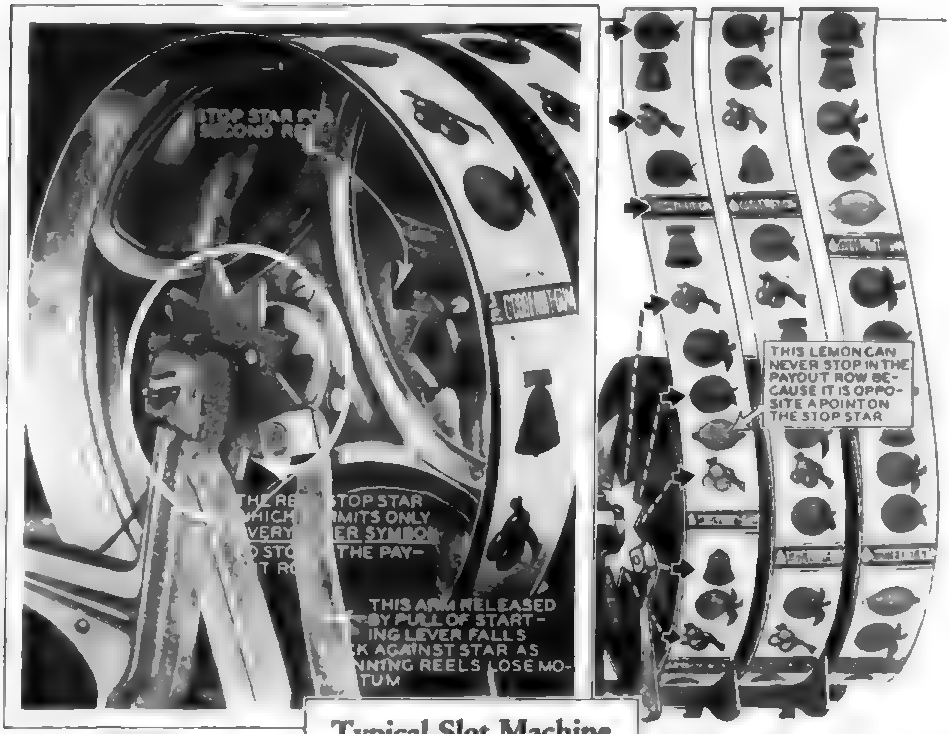
This is what was left after a husky copper swung his trusty sledge into the pile of slot machines shown on opposite page.

Bilking the Transient Trade

So cleverly has this system been figured out that the extraction of money from the player is almost a painless operation. Slot machine playing is perhaps the best (from the racketeer's standpoint) come-on game extant. A player contributes three or four nickels without results, then out pop two nickels; in go six more, and out pop four, etc., etc. Like the mills of the gods, slot machines grind out your money slowly, but inexorably. In fact, so gradually does the player lose his money that he actually enjoys the process.

Most machines are set on the 75-25 basis, but in outlying communities, where transients and tourists comprise the bulk of the

Device Permitting Only Alternate Symbols to Stop Is Secret of Trickery



The stop star, one of which is provided for each of the three reels, makes it mechanically impossible for 10 of the 20 symbols ever to stop in the payout row. The mechanism is clearly shown in the photo above.

This diagram explains more clearly why symbols opposite point on star can't stop in payout row. The window opening of the payout row is placed opposite the V's of the star wheel, therefore symbols opposite points on the stop star will always be halted one step before or behind the payout row—never within it.

trade, operators have machines which take as much as seventy cents out of every dollar played. Recently, when "times got tougher" — or should we suppose the sucker public is getting wiser, and fewer are playing? — operators in the Northwest changed the ratio to as high as 10-90. Such an exorbitant ratio in favor of the operator (10c is paid, out of every dollar played; 90c remains in the machine) is used only to bilk transient trade.

Chicken shacks, wayside beer "joints," and off-the-beaten-track gasoline service stations are the "spots" where these low percentage machines flourish. Obviously, steady customers would soon become aware of such a juicy "cut" for the operator, and stop playing.

The casual slot machine player, who never gives the "game" serious thought, is content to "feed the kitty" whenever he does play, feeling—as he loses—that he is probably playing in ill luck, having just followed a luckier player who has drained the machine of its "gravy." And when this same casual player deposits, for once in his lifetime, one solitary nickel and receives the jackpot (an accumulation of nickels—general 1% of the total deposits from one jackpot pay-out to the next —which pays out when its chamber becomes filled: usually amounting to from $5.00 to $12.00, depending upon the type of machine),

Typical Slot Machine Symbol Line-up

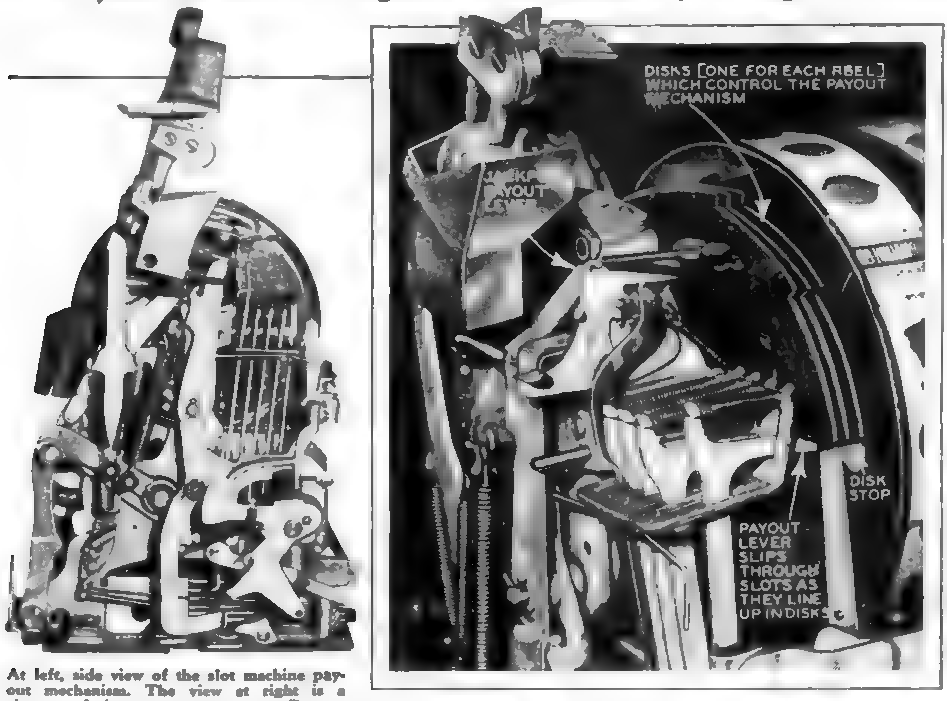
Only 50% of the symbols on the reels of a slot machine can ever stop in the payout row. Those are indicated by * in the list below, taken from a typical machine.

Owners of slot machines change the line-up of symbols occasionally to avert suspicion, if they do business with a regular clientele. If the trade is transient, machines are frequently set to retain 90% of the coins played into them. The premium of 12 nickels for three plums can never be won with the line-up shown, since only the plum symbol on the third reel can ever stop in the pay-out row.

*cherry	*cherry	*plum
orange	bell	orange
*gum	*gum	*lemon
bell	orange	gum
*cherry	*cherry	*plum
plum	bell	orange
*orange	*orange	*lemon
lemon	plum	bell
*cherry	*cherry	*plum
gum	orange	orange
*bell	*gum	*gum
plum	plum	lemon
*cherry	*cherry	*plum
orange	orange	orange
*lemon	*bell	*bell
free play	plum	lemon
*cherry	*cherry	*plum
gum	gum	gum
*orange	*plum	*orange
bell	orange	bell

Symbol line-up of typical slot machine.

The Payout Mechanism Is Ingenious; But Chances of Beating It Are Nil!



At left, side view of the slot machine pay-out mechanism. The view at right is a closeup of the pay-out apparatus. Pay-out levers are in the center foreground; these are fitted with springs which press them against the three black plates which move with the reels. These plates are slotted to permit the lever tip to spring through them when properly lined up—the first lever pays two nickels when it stops against the first disk, as shown; four nickels when it stops against second.

he brays as loudly as the operator wails. But it's only a fake wail, never fear. The casual player in his enthusiasm and the operator in his feigned grief, both make so much noise about it that the operator's "loss" is soon more than compensated by the contributions from other optimistic sheep.

Machines Designed for Easy Play

There are many different styles of slot machines. Some are operated with nickels, others with dimes, some with quarters, and —in the higher-class resorts and exclusive clubs—even with silver dollars! No class, it seems, is immune from the lure of the clicking reels. Slum neighborhoods give nickel and dime devices a vigorous play. Most clubs have nickel and dime machines, and at least one quarter mechanical pick-pocket. The exclusive winter and summer resorts, and almost every big-time gambling casino, have their batteries of dollar machines.

Yes, there are many styles in slot machines, but they're all run on the same (lack of) principle; that is, their mechanisms are similar. They're purposely made easy to play. You simply step up to the innocent-looking lure and put a nickel in the slot at the top of the machine. Then you reach out hopefully and grasp the shiny, attractive lever at the right side of the con*trap*tion. Pull the lever forward, as lightly or as briskly as you will. *Whrrrr* hum the three pictured reels, spinning merrily.

The speed with which they spin depends upon the force you use in pulling the lever forward. Once in a while you'll jerk the lever ever so gently—and find yourself figuratively deluged in a shower of nickels. So you'll jerk the lever gently again. But the gentle touch is no better than the robust pull. You'll discover that in the long run, long before you've lost your last nickel. It just doesn't make any difference how you pull that lever: the machine wasn't made to be beat.

Speed of Reel Doesn't Affect Pay-out

While it appears to be mechanically possible to beat the "game" any number of times in succession, it just can't be done. That little old set screw shown you in the photographs will foil you. That's the jinx to many a breadwinner's fond hopes as he plays his last dollar's worth of nickels in a futile effort to win back that fifteen or twenty dollars he's just let slip away from him.

The hand lever sets the reels in motion and that pesky old set screw slips past the points on the reel stop star and finally, as the reel's spinning dies down, fastens itself in one of the ten notches on the reel stop star. Since there are ten points and ten

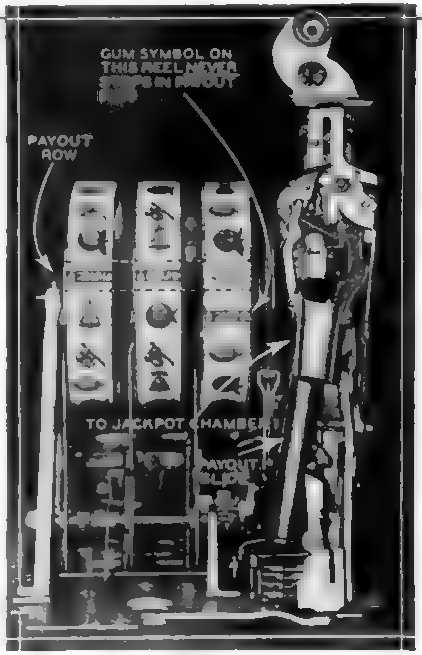
How "75-25" Machine Is Set to Win $12.60 Out of Every $50 Played

1st reel	2nd reel	3rd reel	Prize	Odds	Wins in 1000 plays	Returns in 1000 plays
gum	gum	gum	20 nickels	500 to 1	2	$ 2.00
bell	bell	bell	15 nickels	1000 to 1	1	.30
bell	bell	gum	10 nickels	1000 to 1	1	.20
plum	plum	plum	12 nickels	no chance	0	.00
plum	plum	gum	12 nickels	no chance	0	.00
orange	orange	orange	8 nickels	250 to 1	4	1.00
orange	orange	gum	8 nickels	250 to 1	4	1.00
cherry	cherry	lemon	4 nickels	50 to 1	20	16.00
cherry	cherry	bell	4 nickels	50 to 1	20	8.00
cherry	cherry	anything	2 nickels	6 to 1	166	16.00
					259	$52.40

The table above shows the table of "prizes" on a slot machine set on 75-25 percentage, showing how, for every $50 you spend in the machine, one-fourth of your money is kept by the device.

notches on each of the three reel-stop stars (one controlling each reel), it is certain and immutable that only ten of the twenty symbols on each reel can ever stop in the pay-out row.

Obviously, those symbols opposite the points in the reel stop stars can *never* stop in the pay-out row; only the ten symbols in each reel which parallel the open notches in the reel stop star can do that. As the speed in the spinning of one reel may vary with the speed of each of the other two reels, different combinations of symbols in the pay-out row usually turn up in successive pulls of the lever.



This front view of machine shows two gum symbols and a lemon lined up for a two-nickel payout. The third gum symbol is one row below—it can never line up with the other two for a sixteen-nickel payout.

Although slot machines are legally taboo in most communities throughout the United States, it is quite generally an accepted fact that the authorities are lax in regard to their operation. Owners of machines, usually political powers in their communities, shrewdly insinuate themselves into the favor of church and fraternal organizations by donating the use of several machines at bazaars, lawn, card, and house parties, ice cream socials, and the like, and forego sharing any part of the moneys taken in. Treasuries swell beautifully, as a result, and when complaints later pour into the police chief's office against rampant gambling in his city, the machine owners contact their church and fraternal friends, and the "heat" is forthwith turned off.

Slot Machines That Steal the Rent

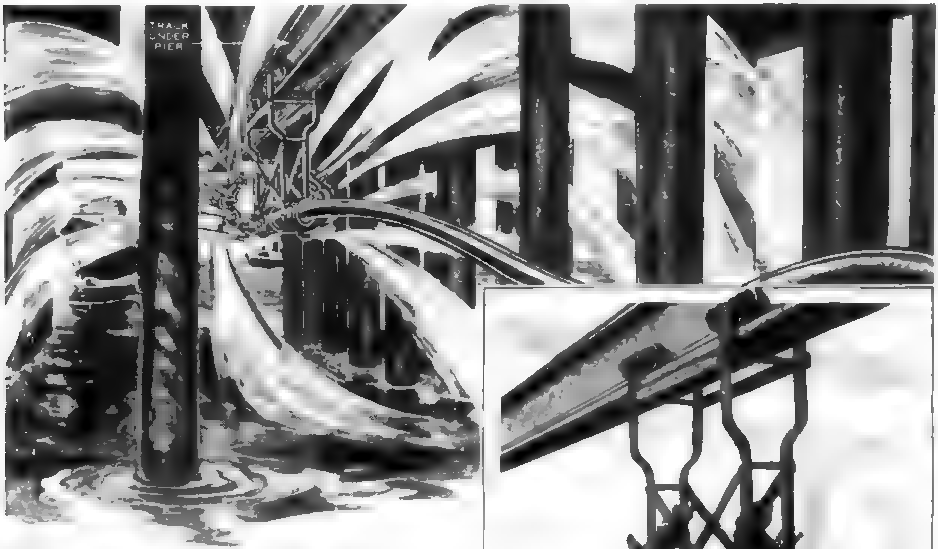
In St. Paul, Minnesota, where a new city administration took office on June 7, 1932, orders were given throughout the city (an earlier grand jury investigation resulted in clearing the county of slot machines) for store owners and club concessionaries to take down the machines. Less than a week passed before barbers, confectioners, beer flat operators, and other small commercial fry started protests by the score for the return of slot machines. These individuals, business being depressed as it is, suffered sorely from the lack of that $3.00 daily profit which their slot machines had averaged.

In many cases, slot machines take in enough to pay the rent. And yet only 50% of the machine's "take" goes to the store operator; the other half goes to the machine owner, who usually owns them in large numbers and places them helter skelter at choice "spots" throughout his police-subsidized territory. These owners, usually politically influential, spend most of their time making contacts with "the right people." When their supply of money runs low, they make the rounds of their "spots," unlock their machines and count out the contents with the shop owner on the well-known "one for me and one for you" basis. Yet on so modest a division of spoils, one little club within the confines of St. Paul netted $3,200 on two nickel and one dime slot machine during 1931; a total "take" of $6,400 for the year, which is a lot of nickels and dimes in any man's country.

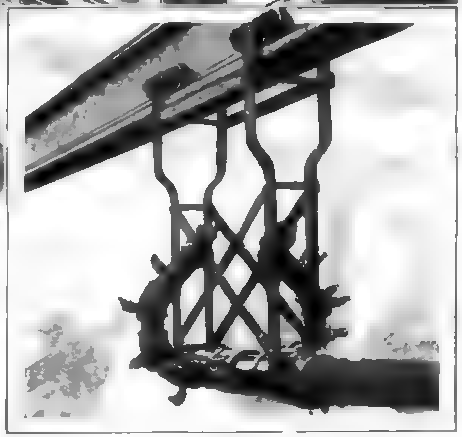
In the summer resorts throughout these United States (whether in the California mountains or the Minnesota fir country) every group of owners knows well the familiar figure of the human jackal who affably places his machines in the choice "spots" and sits back and waits for the killing. He calls regularly throughout the

(Continued on page 160)

"Monorail Nozzle" Combats Pier Fires



Designed to extinguish fires on the underside of pier platforms, this "monorail nozzle" operates as shown above. Pressure forces nozzles along a rail allowing water to reach all parts.

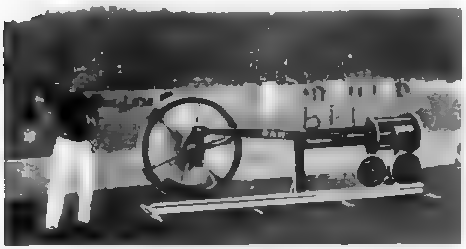


Here is a close-up of a monorail nozzle showing the twenty-six holes set at angles to assure a wide spread of water.

THE recent burning of the gigantic Cunard Line pier inspired William Conrad, a New York inventor, to develop what he terms a monorail nozzle. Due to the inaccessibility of the underside of the pier platform firemen had found it exceedingly difficult successfully to combat the flames. By using this new method, however, fires may be quickly and thoroughly extinguished no matter in what section of the flooring the blazes break out.

As illustrated above, the fire-fighting system consists of numerous nozzles placed at various intervals under the entire length of the pier. These nozzles, each one of which projects twenty-six separate streams of water, are supported by steel monorails running from one side of the pier to the other. Thus as the water is turned on, the pressure causes the nozzles to move along the overhead tracks, each nozzle projecting its powerful stream over an area of forty feet. Each of the twenty-six streams is directed at a different angle permitting the coverage of a great deal of territory and making any section of pier accessible to firemen.

Novel Engine Model Times Steam Roller Cheers of Football Spectators



This mechanical steam roller solved a problem for its inventors—having cheerers keep proper time and rhythm.

EVERY football year brings its quota of innovations in different phases of this thrilling sport. One of the most novel and interesting contraptions devised is shown in the illustration on the left. It is known as a mechanical steamroller and proved the right thing to pep up the spectators when adopted by an Eastern University.

The wide-awake cheerleaders, knowing that the famed steamroller yell depends for its effectiveness upon proper timing, built this machine to guide their audience. It is electrically operated and looks much like the old type train wheel and piston. During the cheering the leader sets the machine so that the wheel rotates in synchronism with the emphatic words of the yells.

Report of Fake Revolver Frightens Away Auto Bandits

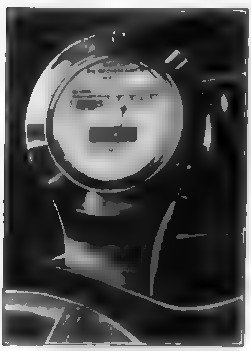
The compressed air revolver attaches to the steering rod as shown in illustration above. The report is much like that of a real gun and will tend to scare away motor bandits.

PROTECTION against the motor bandit is the aim of this new gadget that looks like a regular pistol and fits under the steering column of an automobile. Actually, though, the weapon is operated by compressed air, yet without a bullet. The report is loud enough to frighten away a holdup man, who believes he is being shot at. It is in popular use in England and may be carried by payment of a small fee for which the owner receives a postoffice license.

Roosters Called Origin of Hours

A RUSSIAN observer has advanced a theory of how time was first divided into twelve hours each for night and day, ascribing this custom to the alleged fact that roosters crow almost exactly once an hour all night long. Tests show that the crows of the cock generally are spaced within ten minutes before or after the hour. The theorist believes that primitive man noticed this peculiarity and divided the nights into average "cock-crow" units.

Exact Gasoline Consumption Meter



This meter gives the number of miles per gallon of gas your car is getting regardless of rate of speed at which you are traveling.

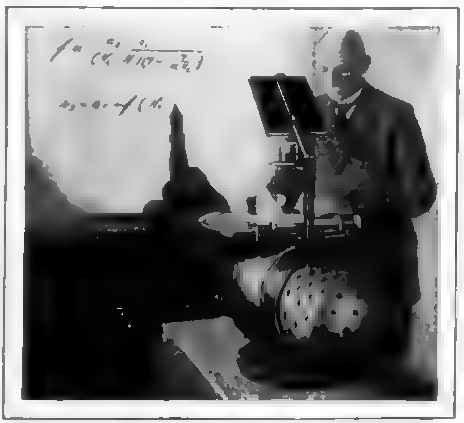
THE device illustrated on the left accurately tells how many miles you are getting to a gallon of gasoline regardless of the rate of speed your automobile is traveling. It is electrically operated and fits on the steering wheel post of the car. Dividing the speedometer reading in miles per hour by the meter reading in gallons per hour will give correct miles per gallon of gasoline.

Girl Patient Has Three Kidneys

A GIRL of fourteen who has an extra kidney, was described at a recent medical conference in England. This third kidney was smaller than the other two and exactly like the kind of primitive kidneys possessed by some of the lowliest of man's evolutionary ancestors.

Like the gill slits of man's ancestral fish which show up occasionally on a human neck or like the appendix which corresponds to the third stomach of grass-eating animals, the extra kidney can be interpreted only as a relic of man's evolution.

Projection Device for Lecturers

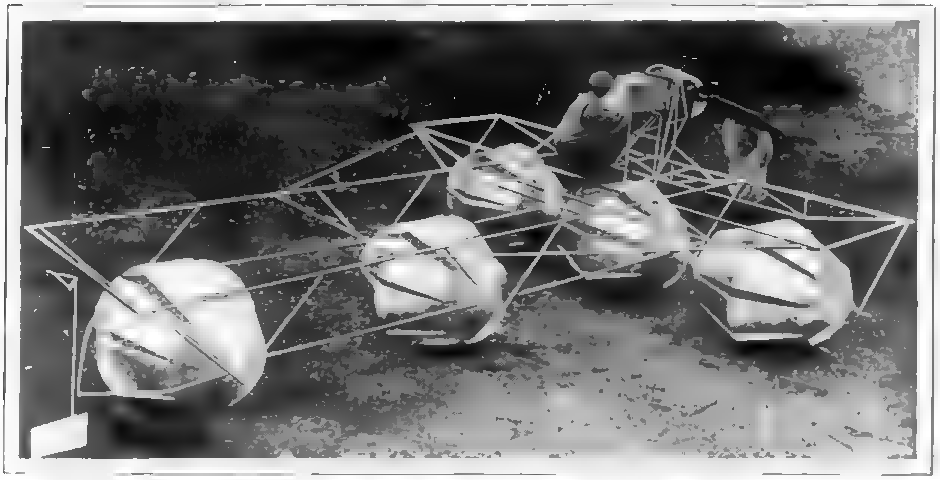


The projection apparatus shown in photo above reflects the lecturer's writing upon a screen in clear view of his audience.

A NEW invention that projects writing upon a screen, thereby doing away with awkward blackboard writing, has been completed in Germany. It is designed for use of lecturers who wish to illustrate their discourse by means of writing, sketches or pictures.

The speaker writes his information upon a cellophane sheet which in turn projects the handwriting, through an optical system and by means of an inclined mirror, onto a screen in view of the audience. When the sheet is filled with writing, a knob is turned and the brightly translucent surface is immediately ready for further service.

High Speed With Low Power Boat Has Pontoons for Hull

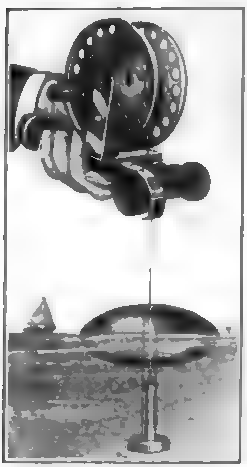


Floating on double cone-shaped drums, this novel craft develops highest speed with a minimum output of power.

A NEW JERSEY inventor has introduced a novel type boat with which he expects to attain highest speed with smallest output of power. Five double cone-shaped welded steel drums which may be seen in the photo above support the craft on the water. It is pushed along by a 65 horsepower airplane engine mounted on the steel framework above the after floats.

As the boat gathers speed the water catches in small depressions in the drums and causes them to rotate. By this rotation they decrease the resistance of the water to the boat as a whole, and thus attain high speed. The boat is steered by an ordinary under-water rudder.

All-purpose Measuring Device



Depth is measured by unreeling line over wheel of counter.

WHEREVER any measuring has to be done a new all-purpose measuring instrument recently put on the market will do the job. Shown at the left, the device consists of a reel around which is wound a fine steel piano wire that passes through a counting wheel. In measuring depth, this wire attaches to a plummet in the manner illustrated. As it is paid out the indicator tells the depth measures horizontally also.

Illumination for Phone Dial

DIALING a telephone number in dim light involves considerable guesswork, and there are plenty of ways to go wrong. A new dial light recently placed on the market, however, eliminates this difficulty. Mounted in the position shown in the photo at the right, the light has a small flashlight bulb in the end which illuminates the dial with a well-distributed beam. The appliance is available for all types of phones—desk dial portable, desk dial cradle, and wall dial phones. Button turns on beam.

Attached as illustrated above, this flashlight illuminates the dial of any type of telephone.

Too Much Dancing Brings T. B.

RECENT scientific investigations have proved that dancing must bear a part of the responsibility for the increase of tuberculosis among young people. Addiction to the terpsichorean diversion usually results in loss of sleep, which cannot be made up adequately on other nights. Insufficient rest and sleep lowers bodily resistance and gives the tuberculosis germs an easy conquest.

Daylight saving also has a hand in inflicting tuberculosis on young people, since it shortens the time permitted for sleeping. Children especially need all the rest they can get.

Tail Light Like Neon Tube Prevents Smash-up in Rear

New tail light, tubular in shape and extending across rear of car above bumper, emits bar of light like neon tube penetrating the thickest fog to prevent rear-end collisions.

HAVING the appearance of a glowing neon tube extending across the stern of an automobile like an illuminated bumper, a radically different safety tail light has recently been introduced which promises to reduce rear-end collisions to a negligible figure.

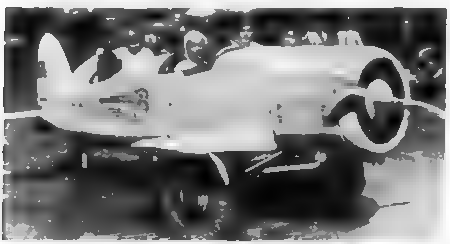
Tubular in appearance, the light has a diameter of 3 in. and ranges in length from 54 in. to 90 in., depending upon the width of the vehicle on which it is to be used. Illumination is furnished by two standard tail light bulbs, incorporated in the tube and emitting a bar of light 1½ in. wide.

The device can be installed in any pleasure car, truck or bus in less than 30 minutes.

Idea for Thwarted Aeronauts

WHEN Grover E. Olds, an aviation fan of Indianapolis, Indiana, was refused renewal of his pilot's license due to a defect of eyesight, he appeased his yearning for things aeronautical by building himself a facsimile of Lindbergh's famous Lockheed Sirius, but for ground use only.

Shown below the plane has an over all length of 15 feet. It develops a speed of 65 miles an hour on the ground, and gets 50 miles on a gallon of gas.



This replica of Lindbergh's lockheed Sirius was built by thwarted pilot to satisfy his aeronautical urge. On the road it develops a speed of 65 m.p.h. The prop is a dummy.

Beryllium May Replace Aluminum

CONQUEST of the stubborn brittleness of the metal beryllium, so that it may become useful in industry, is implied by a recent report to the British Institute of Metals. Beryllium is the world's lightest useful metal, even lighter than aluminum. It may be made as hard and strong as steel, possibly stronger. The reason why it has been little used is that it usually is almost as brittle as glass, so that an article like a beryllium airplane wing would break into fragments if struck with a hammer or if the airplane happened to hit a bird.

Mechanical Miniature Ball Game

Mechanical pitcher in new baseball game tosses ball to mechanical batter, who strikes out or knocks 1,2, 3-baggers or home run. Strings are used to control the players.

A BASEBALL game for parlor use has been invented that is the nearest thing yet to the actual "national sport." On a miniature baseball field are mechanical players which are operated by the contestants. The man playing for the "outs" winds up his pitcher and releases the spring, sending the ball toward the batter of the opposing side.

His opponent sights the bat of his "batter up" on the ball in the pitcher's hand. At a given signal by the "umpire" both players let go simultaneously. If the player aiming the bat has sighted well the bat will strike the ball. Hits, runs, strikes and balls are made just as in a regular game.

Fire Extinguisher for the Home

IDEAL for the home because of its low price, is a new fire extinguisher recently put on the market. The chemical used is a special powder which forms a harmless gas that immediately extinguishes fires. A pump handle action delivers the stream of powder particles to the scene of the blazes. Very convenient also for automobiles.

Simplicity and low cost of this new fire extinguisher makes it ideal for use in the home. Pumping handle emits a cloud of powder particles which smother the blaze.

Hydroplane on Pontoons Turns in Own Length, Draws 1 In.

Mr. Lake demonstrating how his "hydroplane-pontoon boat" will turn in its own length at high speed.

Above is seen the new Lake "hydroplane-pontoon" boat afloat, drawing only six inches. When under way it has draft of only one inch. Note how the pontoons are hinged to side of fuselage. Shock absorbing springs inside the upright cylinder serve to keep the fuselage always on even keel even in roughest water. Stern view of the freak craft at left shows how rear pontoon, which does duty as rudder, banks in synchronism with tilt of the side pontoons.

A SENSATIONAL development in the boating world has appeared in the form of a craft floating on three adjustable pontoons which draw only one inch of water when in motion and six inches when at rest. Thomas A. E. Lake, son of Simon Lake, the famous submarine inventor, introduced the "hydroplane-pontoon boat" as he calls it.

In tests conducted on the waters of Long Island Sound, the freak craft amazed spectators by its ability to turn in its own length regardless of speed and without the slightest evidence of side-slipping.

Supported by three pontoons equipped with spring cushions, the fuselage automatically maintains an even keel, sideways as well as fore and aft, even in the roughest water. The springs absorb all the shock.

Although of unusual design the craft is surprisingly easy to handle. Turning the steering wheel in the usual manner alters the angle of the two front pontoons and at the same time turns the rear pontoon, which causes the stern to swing around the forward end. The moment the forward pontoons are banked and the rear pontoon is steered to either side the forward momentum is checked and the craft immediately takes the desired course.

Another interesting feature of this boat is its propeller, which extends down through the middle of the craft, immediately under the cockpit, and pulls the craft instead of pushing it. The propeller thus becomes the actual turning point of the boat.

The propeller is attached to the motor by means of a hinged shaft which enables the operator to easily draw it up into the cockpit for the purpose of replacing the blades or for storage. A special motor may drive the boat 150 m.p.h.

Ideas for MAKING

Painting house numbers on curbs where they can easily be seen is a profitable source of income for this young man. The only equipment required is a can of paint and stencils, cut from light cardboard, as shown at the left.

Stenciling House Numbers

EVER try to find a house number after dark? Practically everybody has had the annoying experience of searching for some house number hidden by vines, concealed inside a porch, or painted over so that it is almost invisible. That's why the idea of stenciling house numbers on curbstones, where they can easily be distinguished by motorists, is such a practical one. Ninety per cent of all householders approached, remembering some of their own experiences, will gladly pay 25 cents to have the identifying number of their homes painted on the curb where friends calling for the first time can easily find it.

Equipment required is simple and should not cost over 50 cents. You need eleven stencils which you can cut yourself out of oiled stencil paper or light cardboard—one large rectangular stencil, which is used for painting a white background on the curb, and ten stencils containing figures from one to zero, with which any combination of numbers can be made. A can of white and black paint, and brushes for each, complete your outfit.

One young fellow working this stunt makes $3 every afternoon after school. His selling method is as follows: He secures an order from some home in the middle of a block and paints the white rectangle on the curb. Then, soliciting other homes across the street, he points to the spot he has just painted, explains its purpose and the fact that other home owners in the block are having him do a similar job for them, and in nine cases out of ten winds up with an order. He then paints the white background and the following day stencils in the black figures, collecting his money when the job is finished.

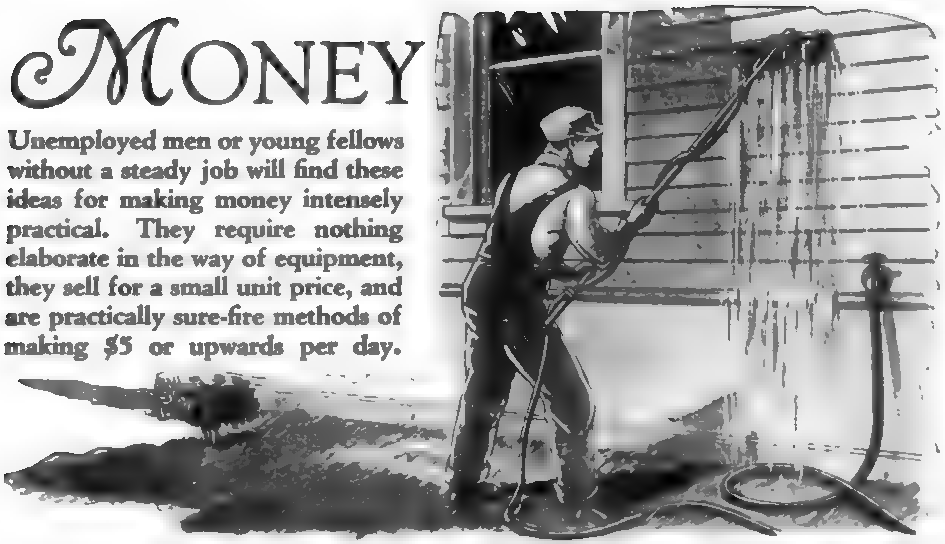
Fixing Leaky Faucets

This idea is a good one to work in connection with the one described above—or, of course, it is perfectly good worked by itself. Almost every home has one or more water faucets whose washers are worn out, permitting them to drip incessantly, much to the annoyance of the housewife. Curiously enough, simple jobs such as replacing washers are always the ones which are neglected by the man of the house, and the task is such a trivial one that a plumber is rarely called in to take care of it.

This is your opportunity. You can buy washers by the dozen at any hardware store at nominal cost. With these washers and a stout monkey wrench in your pocket, you're

MONEY

Unemployed men or young fellows without a steady job will find these ideas for making money intensely practical. They require nothing elaborate in the way of equipment, they sell for a small unit price, and are practically sure-fire methods of making $5 or upwards per day.



With a home-made device consisting of several sponges mounted on a cross bar, through which water runs from the garden hose, a house can have its face washed in a short time, with much the same result as a coat of fresh paint.

all set to tackle the job. All you have to do is turn off the water where it enters the pipes, unscrew the faucet, insert the fresh washer, tighten the assembly up, and collect two bits for your services. If faucetitis is rampant all over the house, you may be able to pick up a dollar or more for doctoring 'em up.

Washing Dirty Houses

Now that the dust and grime of summer is giving way to the comparative cleanliness of fall, the time is ripe to freshen up frame houses with a good bath. This idea may strike you as somewhat unusual, but this simply eliminates competition. In the fall, when storm windows are washed and put in place, is the logical time to go over the house itself with a good sponge bath. Skyscrapers are cleaned occasionally with steam, and when they emerge from the process look like brand new buildings. The same is true of houses, particularly those painted in white or light colors. A good water bath, accompanied by vigorous rubbing to loosen up the dirt, has about the same effect on the eye as a fresh coat of paint—and the cost is comparatively trifling.

To outfit yourself as a house washer, secure a few large, cheap sponges and fasten them to the end of a long handle with a crosspiece. Four or five sponges will probably be required to cut a swath a couple of feet wide. Arrange the garden hose to lead up the handle, discharging through the brushes. The use of a sprinkler head here might help. Now, turning on the water, you will find that by rubbing the sponges over the house half a dozen times you've brought out all the fresh color of the paint which has been hidden underneath a coating of dirt which the average house owner doesn't even suspect exists. A demonstration of what washing will do is the most potent means of securing orders.

Your charges here will naturally vary according to the area of the house, whether you have to use ladders for the upper stories, etc.

Insulating Attics and Garages

Few houses indeed are without attic space which is usually a catch-all for everything which doesn't fit into the rest of the home — old trunks, discarded magazines, Aunt Susie's wedding dress, and the like. The jumble of odds and ends which clutters up the place represents a decided economic waste. Attic rooms, when well insulated, are easy to heat because of the natural tendency of hot air to rise from lower rooms. By finishing off the attic attractively, the owner of the house has an extra room for his own use, or one which he can rent out to a roomer who will soon repay the entire original cost of investment and leave a neat profit besides. It's a way of making the house pay its own tax-money.

You can set yourself up as an expert attic finisher, with no more extensive outlay of equipment than saws, hammers, and a few elementary tools. You need not be an expert carpenter, though the more you know about the trade the better. Plan to use Insulite or a similar building board to line the walls and ceiling. These composition boards are made of closely packed fibers which form the most effective insulation against cold and heat imaginable. A few strips of moulding run along the seams where the boards join, and a couple of coats of paint applied to the completed job, finishes up a room at surprisingly low cost.

Any lumber dealer will gladly give you figures on Insulite which will enable you to

Hot Water Heating Plant for Your Garage Eases Cold Weather Starting

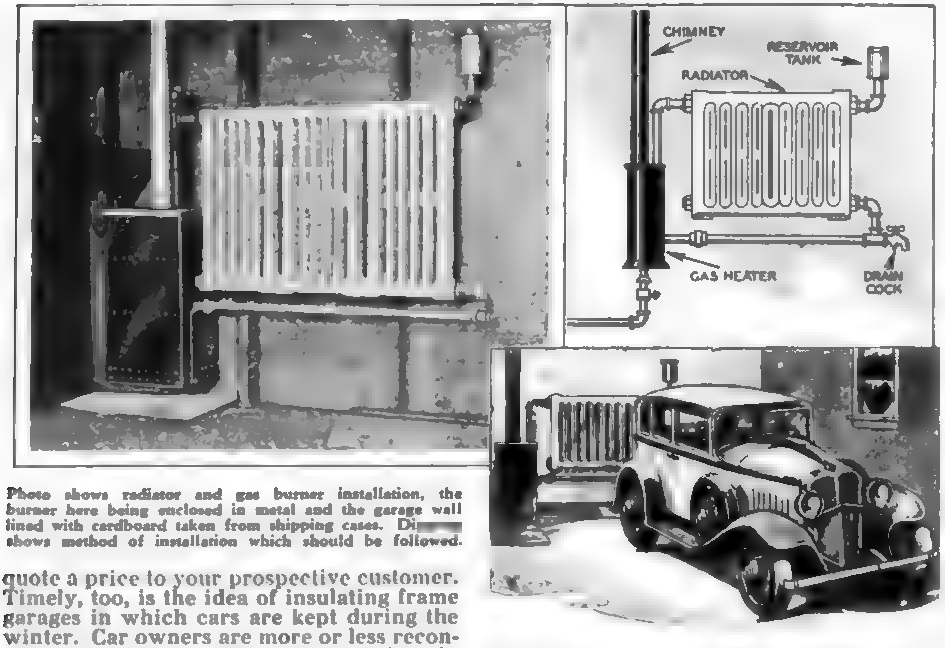


Photo shows radiator and gas burner installation, the burner here being enclosed in metal and the garage wall lined with cardboard taken from shipping cases. Diagram shows method of installation which should be followed.

quote a price to your prospective customer. Timely, too, is the idea of insulating frame garages in which cars are kept during the winter. Car owners are more or less reconciled to the idea of difficult starting in sub-zero temperatures, but you can point out to such individuals that if their garages are lined with insulating board, they can install a cheap kerosene burner which will keep the temperature well above the freezing point. In fact, the typical one-car garage, if well insulated, will remain at a comfortable temperature from the heat given off by the car's motor as it cools off after the day's use.

Plenty of money to be made here for the man who's willing to exert himself to acquire it.

This idea can be worked in connection with the insulation stunt previously described. It is a heating plant for a garage which costs no more than $10 to install, to which you can add a respectable profit. As the photographs show, the plant consists of a hot-water radiator, an ordinary gas hot-water heater, and several lengths of gas pipe.

A dollar a month is the approximate upkeep cost of this heating plant, plenty reasonable when you consider the exasperating starting delays usually attendant on sub-zero weather. This particular heating plant has been proved and tested to maintain a minimum of 50 degrees in the coldest weather, and even higher if desired. This was in an ordinary frame garage; with the addition of insulation to the walls, the temperature can be kept as comfortable as an ordinary room.

A dry, steady heat is given off and no accumulation of steam in the garage or on the automobile results. No care of the plant is required, beyond adding about a quart of water each month to take care of evaporation.

In choosing a position for the plant, pick a location most accessible to the house gas supply. The best location is the center of the back wall. Having secured a radiator cheaply from a wrecking company, fasten it to the wall uprights by means of bolts extending through the coils. Place radiator about 18 inches from the floor. The heater is then connected by a ¾-inch pipe for water to the radiator, and by a ⅜-inch pipe for gas to the house gas supply.

An overflow tank, capacity one quart, is placed at upper right of radiator as a steam outlet. A spigot is placed at lower right for drainage purposes. A vent-pipe with damper extends from the heater through the roof or side of garage. It should be long enough to eliminate short, quick drafts. The pipes connecting with the house gas supply may be placed a few inches underground, or under a walk.

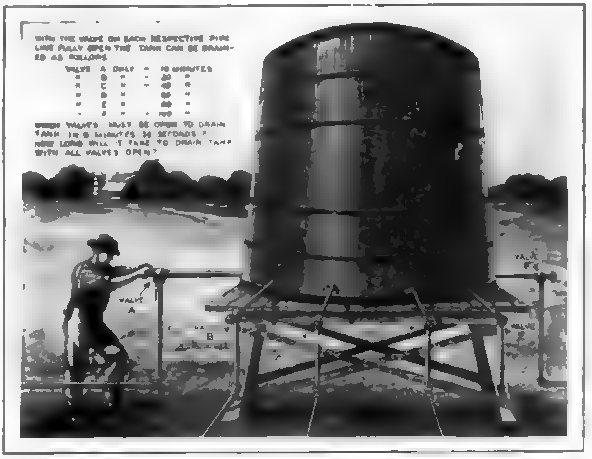
A fairly satisfactory substitute for board insulation can be made from cardboard shipping boxes of the corrugated variety. These can be secured free of cost from most any store. Open up the boxes, cut them into suitable lengths, and tack them in place between the two by fours. Solid cardboard boxes can also be used satisfactorily. Garage doors should be lined with the same material.

Every issue of MODERN MECHANIX AND INVENTIONS carries dozens of ideas for projects which can be built at home and disposed of at profitable prices.

Prize Winner of Tank Drainage Problem

IF YOU'RE ever compelled to make a choice between scooping up all the water in the Pacific Ocean with a thimble and picking out the winner in a contest like this one, choose the former task. It will be a lot easier.

Not only will it involve less labor—it will also permit you to keep your conscience clear, for selecting the prize answer to the tank drainage problem set forth in the September issue of MODERN MECHANIX AND INVENTIONS put upon the judges the necessity of committing some shameful injustices. Only one prize could be awarded, when dozens upon dozens of other letters were almost equally as deserving of first place.



Illustrated here is the tank-drainage problem set forth in the September Modern Mechanix and Inventions. L. Z. Crozier, of Ottumwa, Iowa, wins the $10 prize with answers: Valves B, C, D, and E must be open to drain the tank in 9 minutes and 36 seconds. With all valves opened tank can be drained in 4 minutes and 40 plus seconds.

One of the contest judges, however, got a tremendous thrill out of reading through the piles of letters, for one of his pet theories was confirmed. His theory was this, that one of the fundamental elements of a mechanical-minded person is a logical, precise and keenly analytical mind that penetrates immediately to the heart of a situation. When a solution has been reached, he then sets it down clearly, concisely, with an irreducible minimum of non-essentials, and has done. And in these days, with our economic system in a wretched mess, such habits of mind are our only salvation.

Prize Goes to L. Z. Crozier, Ottumwa, Iowa

Now let *us* get down to essentials. The prize of $10 for the best solution to the tank drainage problem goes to L. Z. Crozier, 107 S. Adella, Ottumwa, Iowa. For brevity with clarity, for neatness of script and for accuracy, Mr. Crozier's letter was unexcelled, the judges opined.

To refresh your memory let's restate the problem, illustrated in an accompanying drawing.

With the valve on each respective pipe line fully open, the tank can be drained as follows: With valve A only—10 min., B—20 min., C—40 min., D—60 min., E—80 min., F—100 min. Which valves must be open to drain the tank in 9 minutes, 36 seconds? How long will it take to drain the tank with all the valves open?

Here's Prize-winning Letter

The following is Mr. Crozier's prize-winning answer.

Valves B, C, D, E, must be open to drain in 9 minutes, 36 seconds. Total time with all valves open, 4 minutes, 40 40/257 seconds.

First let us find how long it takes to empty the tank with all valves open. Valve A in one minute will drain 1/10 of the contents, B 1/20, C 1/40, D 1/60, E 1/80 and valve F 1/100. Reducing to the common denominator 1,200, and adding the fractions 120/1,200, 60/1,200, 30/1,200, 20/1,200, 15/1,200, and 12/1,200 we get the sum of 257/1,200, which fraction of the whole all valves will drain in 1 minute. As there are 1,200/1,200 parts in the whole, then the time consumed will be 1,200 divided by 257 or 4 172/257 minutes. Reducing this to minutes and seconds we get *4 minutes, 40 40/257 seconds.*

To empty the tank in 9 minutes, 36 seconds, or 9.6 minutes. Our denominator is 1,200. Dividing this by 9.6 we get 125. Where 257/1,200 was the sum of the fractions with all valves open, we must now arrange the valves so that the sum is 125/1,200. By inspection of the fractions 120/1,200, 60/1,200, 30/1,200, 20/1,200, 15/1,200, and 12/1,200,we find the only combination of these numerators which will give 125 is 60, 30, 20, and 15. These correspond to the fractional parts in one minute of *valves B, C, D, and E, which valves must be open.*

Letters Get Honorary Mention

Of the hundreds of other puzzle puzzle-solvers who came within a hair's breadth of taking the prize the following lead the field: Lawrence M. Helfgott, who worked out the problem by the percentage method, C. Ernst Redman, who employed the fraction method, E. J. Johnson, W. C. Porter, Jr., Ernest N. Corbishley, James McIvor, Walter P. R. Pember, Lindsey Driver, Richard C. Darnell, of the U. S. Experimental Model Basin, in Washington, C. F. Itzen, Walter B. Brown, K. H. Heilig, Paul H. Lahr, Henry J. Lange, F. M. Kyte, G. E. Miller, and so on and on, but we're out of space.

6,500-foot Tower Is Proposed For Chicago's World's Fair

The above photo shows four towers, ranging from 1,500 feet to 6,500 feet, submitted as models for 1933 Fair.

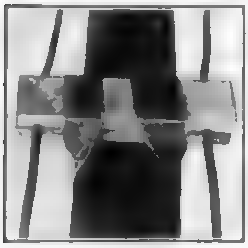
A TOWER higher than any structure now standing is being planned for the World's Fair. Franklin H. Ellison, shown on the left with the four models he submitted, ranging from 1,500 feet to 6,500 feet high, hopes to be the architect whose plans are accepted.

His "super-super tower" is a unique project of 48 stories. Perched upon the top, is a 350-foot landing platform that will house from two to three dozen planes as well as three dirigibles. The base of the tower is 1,200 feet and can house both the *Akron* and the *Macon* at one time. The structure has parking space for over 50,000 cars.

The observation platform will be reached by high-speed passenger elevators which can conveniently accommodate over 200,000 persons each day. The construction costs would be defrayed by admission charges.

A Pipe Holds Emergency Wiring

WHILE running a bit of temporary wiring to illuminate an exhibition booth, one electrician found a water pipe made an ideal place from which to drop two of the wires. Fastening them safely and securely was quickly done as shown on left. Two small blocks were drilled, a half hole in each, for the cleats. These were held firmly on the pipe with a strong rubber band cut from an old inner tube and snapped around the small blocks.



A pipe may be used for emergency wiring by running wires through cleats as shown above.

Permanents Dangerous to Brain

A FATAL accident which suggests serious dangers in giving permanent waves has been reported to the French Academy of Medicine. Application of heat was left upon the victim's head too long, resulting in an inflammation of the brain called Meningitis. People with high blood pressure, hardened arteries or abnormal brain conditions should avoid permanent waving altogether, the academy stated.

Roulette Wheel, Ash Tray in One

THE photo below shows a novel device for home use that will afford much amusement as well as usefulness. It is called the "roulette ash tray," and was one of the innovations recently introduced in the Reichs Invention Union in Berlin. Although it has not the many different betting facilities of the larger wheels, it does have the more popular features.

The ash receptacle has numerals painted upon the sides which revolve around a stationary base. There is a marker upon the base which points out the winning number when the wheel comes to a stop.

Miniature "roulette ash-tray," above, has rotatable top.

Sign Drops Down Under License to Tell the Car Is Stolen

A NEW device to combat automobile thieves was recently introduced in England. It consists of a metal plate, usually hidden behind the rear license, which drops into view whenever any person enters or tries to move the car without knowing the whereabouts of a secret switch. The tamperer may go about his business in a leisurely fashion without knowing he is being revealed as a criminal "to the eyes of the world." The novel idea, illustrated on right, allows motorists to park their cars in comparative safety.

Here is the latest invention to combat the auto thief. When car is invaded, catch drops special plate as shown above.

Non-creasing Cotton and Rayon

COTTON and rayon dress goods which will remain smooth and uncreased when the wearer sits down have been perfected in England. Chemical substances are added which give the individual fibers more resistance to bending and to taking a "set" when bent forcibly.

The materials actually used consist of what are called "condensation" products, in which several molecules of a simple compound such as sugar or carbolic acid are persuaded to combine permanently into larger condensed molecules. A very little of such a condensation product is soaked into the cotton or rayon thread. Fabrics made from this then become quite as "uncreasable" as wool or silk.

New Aid for the Sightless

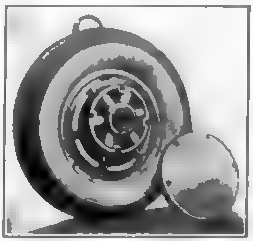
Above photo shows the inventor of an optic prothesis training blind patient to distinguish between light and dark.

IT HAS long been thought an impossibility to train the blind to see, but it remained for a blind Viennese eye-doctor, Fritz Guggi, to refute this idea. Through his efforts, a great advancement in medical science has been made.

The photo above shows Dr. Guggi working on one of his many patients. The invention, an optical prothesis, enables blind people to train themselves to distinguish between dark and light. With correct and additional practice, his method allows blind people to see and distinguish objects.

Steam-driven Wheels for Cars

AN AUTOMOBILE carrying motors in its wheels is being perfected in a Chicago laboratory. Each wheel contains a six-cylinder engine fed with steam through the hub, and mounted eccentrically to the wheel proper. The piston rods of the steam wheel descend one after another propelling the car ever forward. An automobile so equipped, inventors claim, could travel at a speed of 100 miles an hour and cover 2,000 miles without refueling. This would be a great advantage, especially to high-speed cross-country busses which waste time filling gas tanks en route.



Here is a view of the working model for the new steam-driven wheels for automobiles.

Flashlight Has Own Power Plant

Twisting the handle generates power in this flashlight.

THE latest thing in flashlights is this "Bat-Les Lite." It is equipped with three lamps, two of which are held in reserve by clips just back of reflector. When showing signs of dimming, a twist of the handle will generate new power, thereby doing away with batteries.

Slide Down Ropes to Safety in New Life Saving Device

Trapped in burning building, victim can slide to safety on pair of ropes as illustrated here. Note how belt supports the rescued person in new life saving device.

THAT life saving equipment need not be elaborate and expensive effectively to remove people from a burning building is demonstrated in the introduction in Germany of a new device called the "servitor."

The contraption consists of nothing more than a pair of stout ropes which are hooked to a window frame and down which the victim slides to safety.

This sliding is performed in a special gadget having a couple of handles, as illustrated in the photo at the left. A life belt is strapped about the victim's middle to insure a comfortable trip earthward.

Tests proved that 30 persons can be rescued in 12 minutes.

Steel Ousts Lumber from House

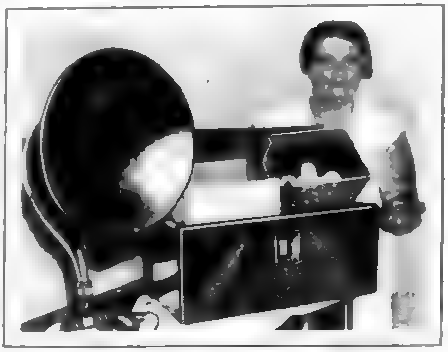
A FRAMELESS steel house which may point the way to cheaper and better homes has been built by way of experimentation in Solon, Ohio, a suburb of Cleveland. The walls, as demonstrated below, were assembled in large sections, with window and door frames in place. These sections are welded together in an amazingly short time, only one welding outfit and two workmen being employed on the job.

The floors, like the walls, are of 18-gauge Armco steel, and are also welded together, giving the structure exceptional strength. The exterior of the house is covered with porcelain enameled shingles. Thus the house never requires painting, a bath with a garden hose sufficing quickly to restore the original luster.

Here workmen are seen setting steel plate in place to build up walls of new frameless house. Tile covers exterior.

Radio Set Is Mother of Chicks

NOT to a radio expert but to a housewife, Mrs. Johannes Ronn, of Kansas City, Mo., goes the honor of putting to useful service the heat emanating from tubes in a radio set. What she did in effect was to make the set do duty as an incubator. She placed the eggs in a pasteboard box and put the box in the radio. After the proper lapse of time four little brown chicks opened their eyes to the world. The chicks will have the unprecedented honor of calling a radio set their mother.



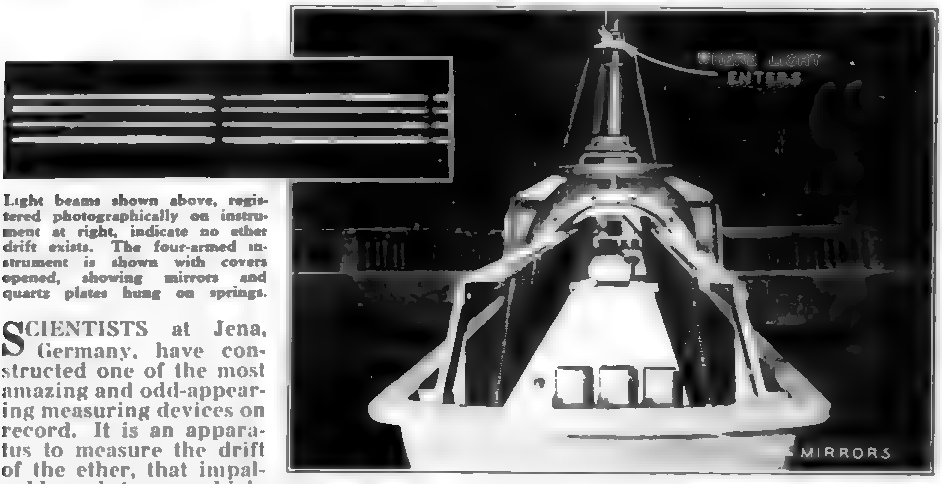
Heat from tubes of broadcast set hatched these chicks. Eggs were simply placed in pasteboard box and laid away in the radio's innards. Try the idea on your B.C. set.

Lots of Dust in Air This Year

THE recent "pink eclipse" of the moon observed in France and England, is believed to indicate the presence in the earth's atmosphere this year of more than the usual amount of air dust, probably derived from volcanic explosions in South America months ago.

Observers noticed that the moon looked pink or copper-colored, indicating that the light which had passed through the earth's air was reddened in the process, like the red light produced when sunlight passes through a great thickness of air at sunset or sunrise. Almost always such reddening of the sunlight is due to dust in the air.

Queer Machine Checks Up on Ether Drift



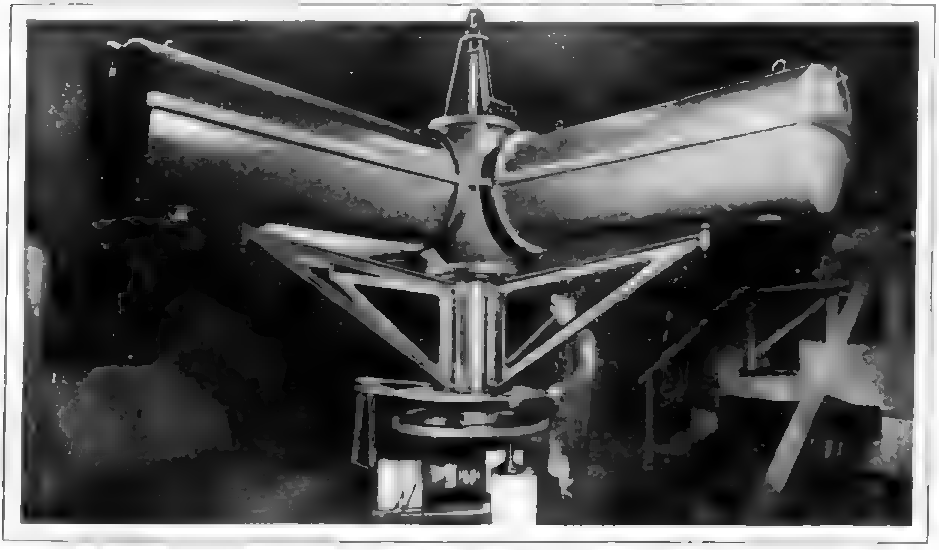
Light beams shown above, registered photographically on instrument at right, indicate no ether drift exists. The four-armed instrument is shown with covers opened, showing mirrors and quartz plates hung on springs.

SCIENTISTS at Jena, Germany, have constructed one of the most amazing and odd-appearing measuring devices on record. It is an apparatus to measure the drift of the ether, that impalpable substance which, according to one school of thought, fills the space in which the universe swims. Theoretically the motion of the earth, passing through this ether, should set up a drift comparable to the breeze generated by the motion of an automobile through the air.

To determine if such a drift actually does exist, the elaborate optical apparatus shown on this page was built by German scientists. It consists of four arms on a perpendicular axis, containing a series of mirrors, lenses, and reflecting plates. A ray of light enters at the top of the device and is bounced back and forth thousands of times, finally emerging at the bottom, where its passing leaves a record on a photographic plate.

A study of the photographs, one of which is reproduced above, leads scientists to the conclusion that ether drift, if it exists at all, must be less than 1½ miles per second, instead of the 10 mile per second figure arrived at by some earlier investigators. Complicated mathematics involving the bending of light rays entered into the scientific conclusions.

All previous experiments of this nature have depended on the human eye for their conclusions.

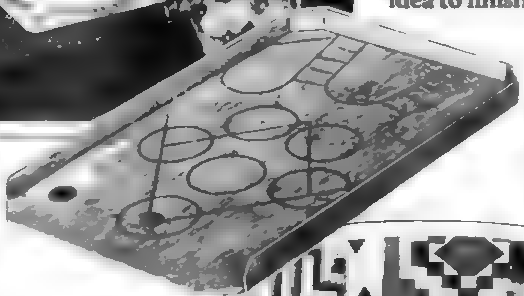


Revolved once every 10 minutes by an electric motor, light beams are reflected back and forth many times by a series of lenses and mirrors in the apparatus, to be finally recorded on the sensitized plates of a camera at base of machine.

Let's Invent a Game!

Few fields of invention offer more lucrative possibilities to the amateur than that of games. Mr. Cross, himself a successful game inventor, tells you here exactly what sort of games draw big-money royalties for their designers, and traces the development of one of his own games from germinal idea to finished product.

Games fall generally into two broad classifications—those of chance and those of skill. Chance games appeal purely to the gambling instinct. To secure commercial success, a game must involve elements of intellectual contest.



Sports are frequently reflected in games. The board at left represents a baseball diamond. Game is played with tiddle-dy-winks.

Some games appeal exclusively to children, usually those in which no great degree of concentration is required. Inventor must decide to what buying public his game is best adapted.

WOULD you like to invent a game? If you were lucky enough to invent a hit like Pit, or Flinch, or Rook, you might retire and spend the remainder of your life in ease. Pit sold more than a million packs in the first twelve months after it was placed on the market, and has been a star seller ever since. Flinch has amassed a grand total of seven million sales in the thirty-eight years since it appeared. And Rook has outsold both of them. With a royalty of from five to ten per cent, which the manufacturers commonly pay, the inventor who can originate a game that even approximates the popularity of these big-timers, is obviously on the high road to affluence.

There is no field of invention which offers better opportunities for the amateur who will take the trouble to consider the elements with which he must work. Game manufacturers are constantly on the lookout for new ideas.

"We're always in the market for a good new game," declares Mr. George S. Parker, President of Parker Brothers of Salem, Massachusetts.

And a similar assurance comes from the Milton Bradley Company of Springfield, also in the Bay State, through Mr. George A. Fox, manager of the game department.

These two companies lead the world in the manufacture of miscellaneous games, but there are many smaller companies which are also glad to consider new games, possessing the qualities essential to salability.

Probably the most satisfactory way to explain these qualities, as well as the other

by **FRANK CLAY CROSS**

elements which the game inventor must keep in mind, would be to discuss them in connection with a concrete example. So let's invent a game. Let's proceed, step by step, through the whole process of invention from the search for, and discovery of a germ idea, to the final creation of a game which will be absolutely new and marketable.

There is no better place to look for a germ idea than among old games. Modern games, with very few exceptions, are simply novel developments of ideas which have long been known. Camelot, for instance, which is just now a very popular form of pastime, was suggested by chess and checkers, both many centuries old. Pollyanna, a favorite game for children, and numerous other games using dice or spinners to determine the moves of men on boards of various design, are all sprung either from backgammon, which was played by the ancient Greeks and Romans, or from Pachisi, an old Hindu game with many points of similarity.

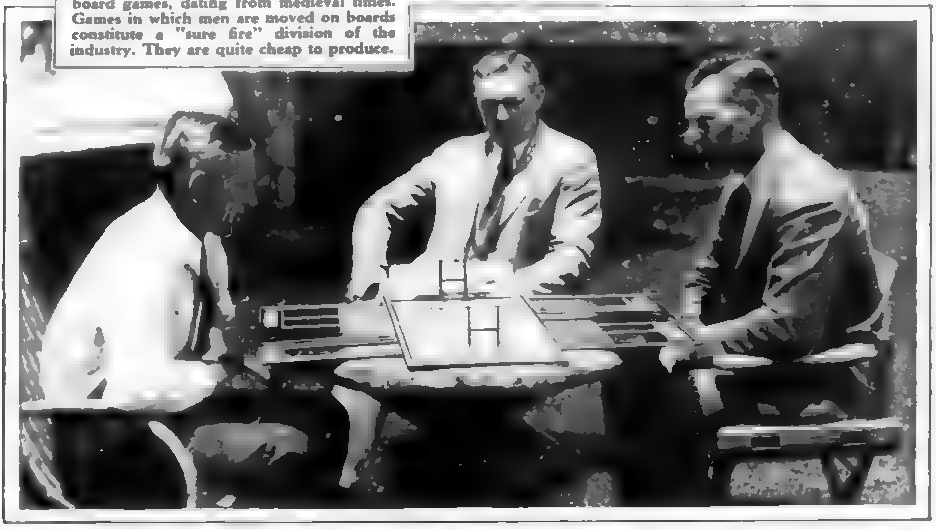
Ping Pong is a miniature form of tennis, and many other indoor games have been inspired by golf, cricket, baseball, football, racing and other outdoor sports. Flinch is merely an elaboration of an old card game, called *Grabouge;* and Rook is several old-time games played with a pack of cards which differs from an ordinary pack only in that four colors are used to designate the suits, instead of hearts, diamonds, clubs and spades, and numerals from one to thirteen are substituted for pips and faces.

Chess is one of the oldest examples of board games, dating from medieval times. Games in which men are moved on boards constitute a "sure fire" division of the industry. They are quite cheap to produce.

Inventors Must Develop New Slant

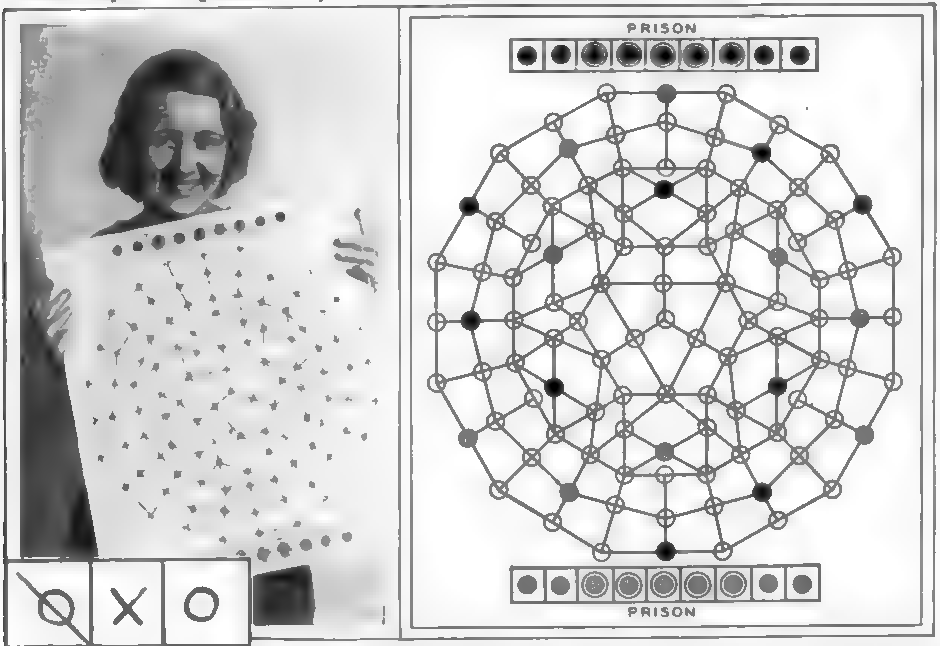
The inventor who undertakes to alter or elaborate some old game, however, must be extremely cautious to avoid simple imitation. He must either develop the germ idea in an absolutely new way, or else he must take advantage of some popular fancy which will strongly promote the sale of the game evolved by him. Flinch and Rook, for example, took advantage of the prejudice which many people entertain for playing cards. They are glad to play the old-time card games, however, when given an opportunity to do so with pasteboards of a different design.

Now let's see if we can't discover some old game with a germ idea, not already overworked by other inventors, which we can develop into a new game. How about "Tit-tat-toe, Three in a row"? That's a very simple little game, played with pen-



This football game, played on a board, is so scientifically designed that famous coaches use it in devising new gridiron plays. Left to right, Coach Howard Jones, U. of Southern California, Tom Lieb of Loyola, and Bill Spaulding of California U

Game of "Triplets," by Mr. Cross, Evolved Out of "Tit-Tat-Toe"



Girl in photograph is holding board on which Mr. Cross's game of TRIPLETS is played. The playing diagram above, whose rules of play are given in this article, was developed out of the familiar school game of "tit-tat-toe, three in a row."

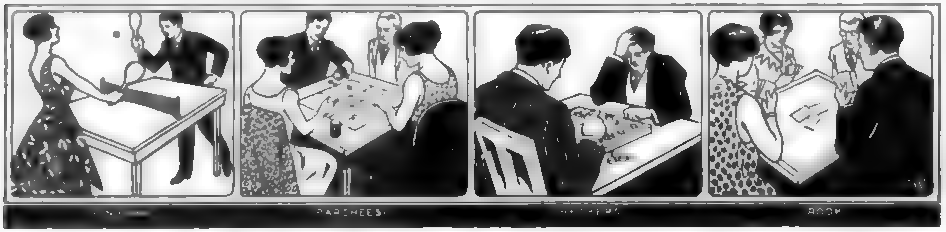
cils and a sheet of paper. Perhaps we can elaborate it into a form that will afford much worthier competition.

This germ idea immediately enables us to predict several significant features of any game which we are likely to develop from it. Obviously, instead of circles and crosses pencilled into a crude design on a sheet of paper, our game will use men on a board; and one of the primary aims of the players will be to move these men into a row, or rows, of three.

Good board games — let us hope that ours will be a good one — are always in demand. In the first place, like card games, they are usually inexpensive to manufacture. That characteristic is very important, for the manufacturers are usually loath to consider a game that cannot be produced to sell profitably for less than a dollar. The experienced inventor always thinks of production costs.

Another advantage of a board game is that it displays attractively. An attractive display naturally boosts sales.

These comments bring us to the second step in our undertaking. We must now design our board. How shall we go about it? Well, we know that our design must provide a number of combinations of three points in a row. This simple little game of *Tit-tat-toe* has eight such combinations; but our game will have to offer much sterner competition, and consequently it must have many more of them. To get a good design we must simply work with a pencil and a sheet of paper until we devise one that suits us. Let's say that the final result of our labor is shown in the illus-



Board games and card games represent the biggest money-makers in the field. Countless variations have been designed.

Interior of the woodworking department of the largest game factory in the world—Parker Brothers of Salem, Mass.

tration on the opposite page.

Now comes the most difficult problem of all. How is our game to be played? What rules shall we make for it? Right here we must demonstrate our inventive talent at its best. We have already decided that a primary object of the game will be to get three men in a row. What then? Shall we say that the game is won by the player who can first form a given number of three-point combinations? That suggestion might work, but let's try to introduce more novelty. Of course the player who gets three men in a row must achieve some advantage.

Suppose we permit him to bring another man into play each time he does it. There's a humdinger of an idea! And it's original, too! No other game uses it. Three men in a row bring a new man on the board! The new man—let's say—has been a prisoner, and the three men who

A table full of the games which have proved best sellers during the past thirty years. How many do you recognize?

A successful game should be suited for sale at a dollar or less. Manufacturers always consider the cost of production.

Another reason for the popularity of board games—they can easily be worked into attractive displays on sales counters. Also, they can be manufactured to sell at several prices, scaled according to style of finish suited to various tastes.

free him are three musketeers. That calls to mind the famous adventure story of Alexander Dumas. Symbolism always lends charm to a game. In games for children it is almost indispensable.

Now the whole plan of our game begins to be apparent. The winner will be the player who can first liberate a given number of prisoners. If prisoners are to be freed, however, there should also be a way for the opposing player to put them back in prison. It must never be possible to win a game too easily before the spirit of competition between the players has been thoroughly aroused; nor, on the other hand, must the play drag out tediously. A successful game must hit a happy medium. Then there is another extremely important factor to be considered. A chance for the losing player to rally must be available until the very end.

From here on a collaborator is absolutely necessary. We must experiment in actual play with tentative rules until we develop a thoroughly workable set of them; and, as we experiment, we must keep two purposes constantly in mind. First our rules must provide an enjoyable contest; secondly, they must be simple. The inventor who imagines that he can ignore the demand for simplicity is doomed to failure without exception. If his rules cannot be clearly expressed in five, or six, hundred words, or in a thousand at a maximum, there is small likelihood that any manufacturer can be found who will consider his game.

Our rules, as we finally evolve them, are easily inside the limit. We shall give them here, prefaced by a brief description of how to make the equipment for playing our game.

The Game of TRIPLETS

With black India ink draw the design, shown on page 54, on a piece of Bristol Board, about 17"x19". The eighteen points in the concentric diagram are alternately black and red, the red being indicated by the shaded circles.

At each end of the board there is a prison, one red, one black, represented by nine spots in a row.

The game of TRIPLETS is played with twenty-eight men—fourteen red and fourteen black. Of each color, there are nine *musketeers* (checkers with large map tacks driven into their centers), and five *lancers* (checkers without the

(Cont'd on page 152)

DON'TS FOR GAME INVENTORS

George S. Parker, president of Parker Brothers, who himself has invented more than 200 successful games (among them, Pit, Rook and Camelot) prepared the following list of "don'ts" in inventing games for readers of Modern Mechanix and Inventions:

1. Don't slavishly imitate some other game already in existence. Be original.
2. Don't make difficult or intricate playing rules. Strive for simplicity instead.
3. Don't contrive equipment which will be costly to manufacture. Try to invent a game which can be sold for a dollar or less.
4. Don't think you have a salable game unless you are certain it offers enjoyable pastime.
5. Don't submit your game to manufacturers until you have it perfected.

Drawing Pictures Over the Radio Broadcast Is Latest Fad

THOUSANDS of radio listeners are joining in on the fun of the latest broadcast novelty—drawing pictures over the radio. The artist in the studio sketches his model in front of the microphone, making the drawing on a chart ruled off into many squares. Radio listeners provide themselves with a similar chart, and when the artist announces that the line he is drawing passes through a certain numbered square, his audience duplicates the line on its own charts. The result is somewhat similar to the drawings subdivided into tiny squares which are printed in the How-to-Build-it section of MODERN MECHANIX AND INVENTIONS for home craftsmen to copy.

Radio listeners try to duplicate the artist's drawing by the use of a chart divided into tiny numbered squares, as shown.

New Mechanical Chiropractor

WITH a machine like the one shown below in your home, there's no longer any excuse for headaches. At least, that is what the inventor claims for his mechanical chiropractor, which also is supposed to correct curvature of the spine, speed up the circulation and aid digestion. It is self-operated, the patient himself supplying the propelling energy. The machine has a stretching and massaging action on the body structure which is said to promote health and tone up the system generally. It was demonstrated at a recent Chiropractor's Association meeting in Los Angeles.

Self-operated mechanical chiropractor is said to be a sure cure for headaches, curvature of the spine or poor digestion.

Arctic Ocean Getting Warmer

THE surface layer of cold water on the Arctic Ocean is now only 200 feet thick, as compared with a depth of 600 forty years ago when the famous explorer Nansen made his measurements—a fact which leads scientists to believe that the Gulf Stream has warmed the Arctic greatly in the intervening years. Between 600 and 1100 A.D. the Arctic Ocean is believed to have been ice-free, when the Norsemen found the northeastern coast of the continent to be so warm that grapevines grew.

Why Teeth Hurt When Drilled

NO ONE who has had a tooth filled will deny that teeth hurt when the dentist's drill strikes them, but scientists have never been able to discover nerves in the dentine which makes up the bony structure below the tooth's enamel. Then why should the dentine be sensitive? The latest theory is that the dentine is lined with countless tiny canals containing a special kind of living cells which, when disturbed, carry the message of pain to a thin living membrane lining the central pulp cavity in which the nerve and blood vessels are found.

"Electric Jewelry" for Milady

NOW comes an electric light bulb to displace glowing pearls from earrings! The photograph shows a young woman apparently wearing a large pearl earring, but in reality it is a midget electric bulb run from tiny batteries concealed in ornamental coils around it. The bulb is frosted to produce a soft light. It is particularly effective in contrast with dark hair.

This is not a pearl in milady's earring—it's a tiny electric bulb, lighted by a midget battery

Electrical Map Instantly Flashes Location of Radio Station

The electrical radio map shown above will allow radio listeners to locate stations without waiting for the station announcement. The map is attached to the set and a light flashes at point where station is located.

A CLEVER electrical radio map has been devised to determine the location of stations without waiting for announcements. It attaches to the set and automatically flashes a light whenever the dials are turned to a new station.

The map as shown on the left is in black with a background of white. Each state in the union is outlined with a white border which allows a clear vision from a considerable distance. All radio stations are represented by a small light which illuminates the moment sound is heard.

The new device will help pick up the program you wish to hear in a much shorter time than was necessary in the past.

Film Discs Replace Ribbon Film

FILM discs replace ribbon film in a new type movie machine recently introduced. The device projects pictures from a film disc that greatly resembles a phonograph record. The disc measures 18 in. in diameter, which equals 1,000 feet of ordinary movie film. A unique optical arrangement allows the pictures to be transposed from standard sized motion picture films to be printed spirally on the disc.

Although each individual picture is only 5/8"x9/32" in size there is no loss of definition or smoothness on the screen. The great advantage in this new type movie machine is that the disc's film can be used over and over again for at least 10,000 projections as compared to the usual 200 projections which is the life of the conventional type film.

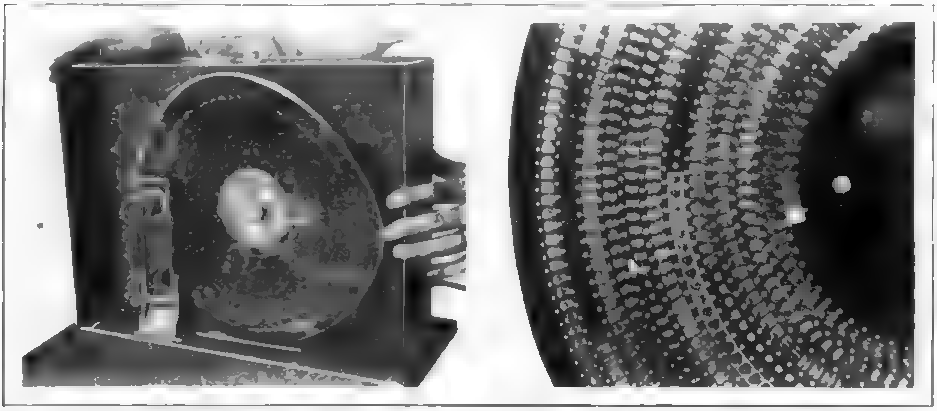
The machine is designed for use in schools and for advertising and industrial use where the disc's long life is a great advantage.

Complete One-Man Mining Camp

The inventor with his complete automobile mining plant.

HARD times have started many prospectors on a search for gold and a modern forty-niner is shown above with his one-man mining plant which is to be used to dredge in the Fraser River in British Columbia.

The automobile carries a good sized suction dredge, sluice boxes and all the necessary tools. A trailer is attached with an ingenious dwelling for the family.



Here is the new type movie machine recently introduced that uses film discs instead of ribbon film. The complete machine weighs 18 pounds and resembles a portable phonograph. The close-up on the right shows picture arrangement.

Old Phonograph Makes Speedy Drier For Wet Fish Lines

BY MOUNTING a drying rack on the turntable of an old phonograph, a speedy means is furnished of unwinding the wet fish line from the reel to the drying rack. As shown in the photograph at the right, the drying reel is quite simple in construction, consisting simply of a hollow square frame in which four upright wooden rods are inserted. The wooden frame is mounted securely to the turntable by means of bolts or screws. To operate, all that is necessary is to tie one end of the line to an upright, set the turntable in motion, and hold the reel while the line unwinds.

Motive power for ingenious fish line drier is supplied by a portable phonograph. Drying rack is mounted on the turntable and is revolved by the phonograph's spring motor.

Handy Self-measuring Oil Can

Small ball bearing dropped into an oil can makes the device self-measuring by plugging the spout.

WHEN IT IS necessary to place a certain definite quantity of oil in each oil hole or cup, a can which will automatically measure quantities is very handy. Such a container is easily constructed. Merely place a small ball bearing inside the can; when the latter is turned over the ball will catch in the spout and permit only a certain amount of oil to flow. The amount is governed by the size of the ball, a large bearing permitting a greater quantity of oil to pass each time than a small one.

Making It Easy to Turn on Light

WITH winter time coming on and the mitten season approaching when the ordinary citizen wears leather mittens as well as the mechanic whose work requires them for protection to his hands, the little stunt illustrated in the photo herewith will prove helpful. The small snap which turns on the electric light is difficult to turn when wearing stiff mittens, but the addition of a spring clip as illustrated makes it easy to turn the light on or off with a mere flip of the wrist. This is a particularly helpful idea for certain shops.

A wooden clip attached to the electric snap switch, as shown, makes it easy to operate even when wearing clumsy mittens.

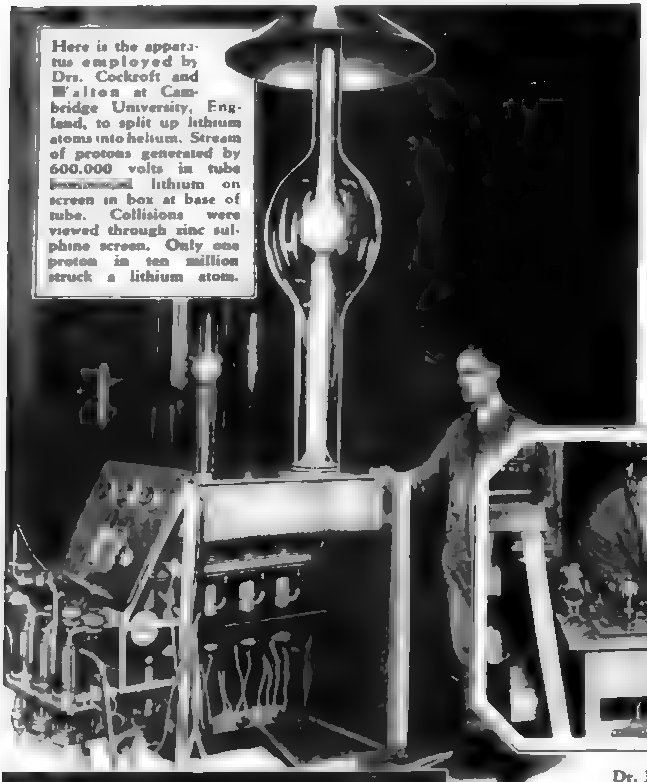
Use Car Power to Grind Meat

NOW you can operate your meat chopper, ice cream freezer, apple parer, or practically any other device turned by a crank without work or worry, thanks to the simple idea of an Illinois inventor. A strap iron strip just long enough to fasten between rim bolts on opposite sides of the car wheel is made. The shaft of the device to be operated is then attached to the center of the strap.

All that remains is to jack up the rear wheel, start up the motor and let 'er rip. The picture below shows the arrangement in operation. It's handy for picnics where much food has to be prepared outdoors. Naturally the shaft of the food chopper must be practically in line with the hub of the wheel.

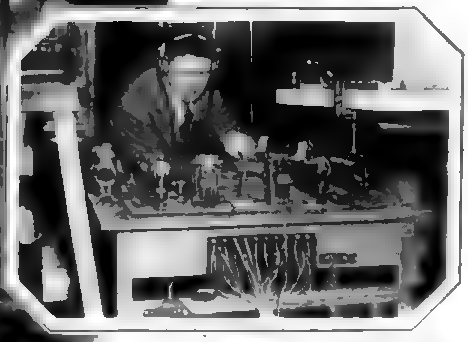
Gasoline power does the work of driving this food chopper, whose shaft is attached to the length of strap iron bolted between two opposite rim lugs of the car wheel, as shown.

BOMBARDING *the Atom*

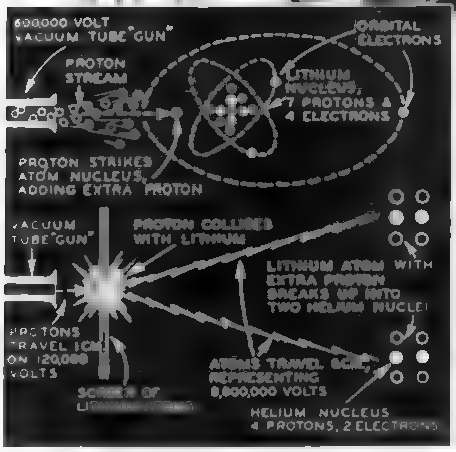


Here is the apparatus employed by Drs. Cockroft and Walton at Cambridge University, England, to split up lithium atoms into helium. Stream of protons generated by 600,000 volts in tube [illegible] lithium on screen in box at base of tube. Collisions were viewed through zinc sulphine screen. Only one proton in ten million struck a lithium atom.

Locked up in the atoms which make up all matter are tremendous stores of energy which, if harnessed, would yield millions of horsepower at a negligible cost. Read here about amazing advances made by science in its attack upon the atom and about the feat, recently achieved, of actually changing mercury into gold.



Dr. J. D. Cockroft at Cavendish laboratory listening to the break-up of lithium atoms.



This drawing illustrates the process whereby lithium atom was actually split up into two helium nuclei by Cambridge scientists. Fast moving proton from 600,000-volt discharge tube strikes lithium atom on screen. Overloaded by addition of extra proton to nucleus, the lithium atom breaks up into two helium nuclei, which collect electrons from air.

by **RUSSELL J. MORT**

IF SCIENCE succeeds in its current quest for a means of splitting atoms on a mass-production scale, and thus making it possible to utilize the tremendous energy bound up in the electron and proton, all the machinery which now furnishes our power may be thrown into the junk heap.

People of a hundred years hence may regard the prime movers of 1932 with the same amusement with which we regard the crude weapons, carts, and fire-making apparatus of primitive men. Instead of the bulky, wasteful machines which we employ today, the people of 2032 may have engines, powered by energy liberated from atoms, that will be so efficient and powerful that a piece of coal the size of a pea will suffice to drive a giant liner like the *Mauretania* across the ocean and back.

Although an opening wedge has been driven into the atom with high voltage machines recently devised, a long, hard road lies ahead of the scientists before they at-

for POWER *and* GOLD

tain their goals. At the end of this road may lie not only the production of power at an amazingly low cost, but also a realization of the age-old dream of the alchemists—the creation of gold from base metals.

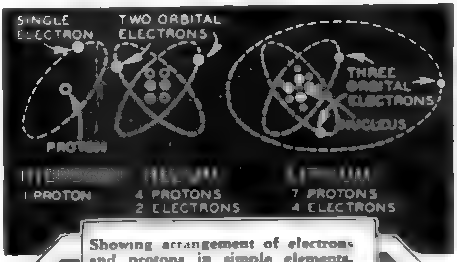
Transmuting one chemical element into another by splitting atoms and adding or subtracting a portion of their protons and electrons has already been accomplished, and it now remains to perform this feat on a large economical scale. Success, which probably lies far in the future, may mean that gold will become as plentiful and inexpensive as substances like lead and iron.

Arrangement of Protons, Electrons in Atom

It is what might be called the "compact looseness" of the atom that defies all attempts to smash it. These atoms are composed of a central nucleus made up of a group of electrons and protons, around which revolve like a planetary system an array of orbital electrons, as you see illustrated in the drawing at the top of the page. The protons are positively charged, while the electrons carry a negative charge. The opposing polarity of these two bodies in the atom is what holds them together, resisting with herculean strength all attempts to break them apart.

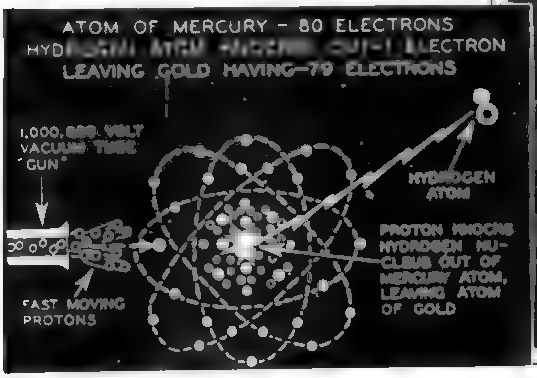
Now the entire universe is made up of 92 chemical elements, which are in turn composed of electrons and protons, sometimes termed by scientists the "building blocks of the universe." The character of each element is determined by the number of protons and electrons in its nucleus and the number of electrons revolving in orbits around this nucleus.

Hydrogen, the element of the lowest atomic weight, has one nuclear proton and one orbital electron. Next comes helium with four nuclear protons and two or-

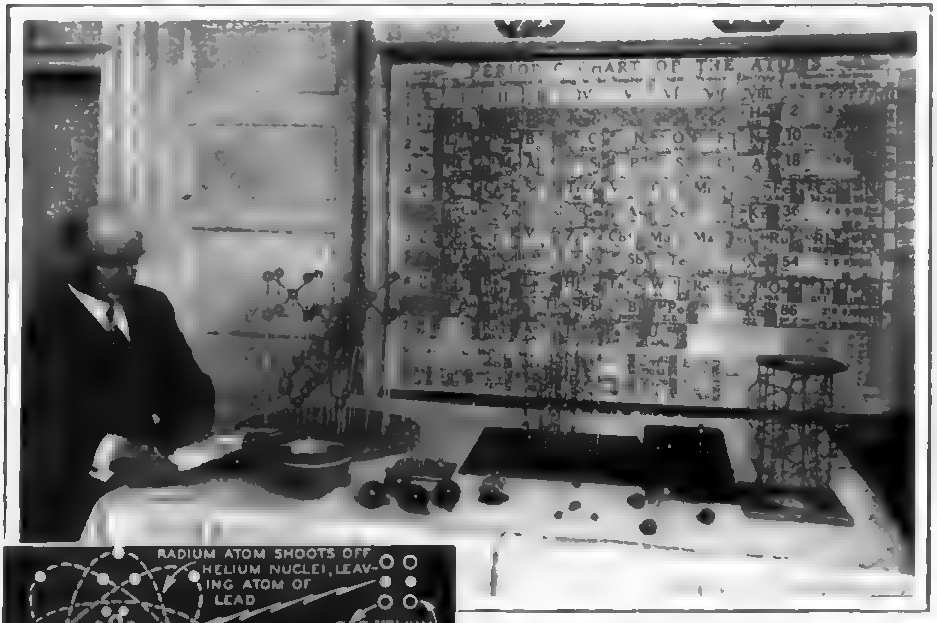


Showing arrangement of electrons and protons in simple elements.

Heinz von Bohndorff, Berlin scientist, who claims to have effected transmutation of mercury into gold.



How mercury was changed into gold in laboratory of Heinz von Bohndorff, German scientist, is illustrated at left above. Bombardment of mercury for forty hours with stream of protons from 1,000,000-volt cathode ray tube broke up the element into atom of hydrogen and atom of gold, actually creating .0008 grams of the precious yellow metal. [illegible] at right shows rectifiers employed by Cockroft and Walton for producing potential of 600,000 volts to split lithium atoms.



How the more complex atoms, such as mercury, gold, uranium, etc., are constructed are illustrated in these ingenious models. Nucleus of the atom, which is positively charged, is encircled by numbers of negatively charged electrons. Opposing polarity binds electric particles together.

In early experiments, "radium guns" were employed to bombard atoms of nitrogen. How radium disintegrates into helium nuclei or powerful "alpha particles," is seen in top drawing. Below is remarkable photo of tracks in cloud chamber made by protons from high voltage tube (right), and alpha particles from radium, (top and bottom).

bital electrons. And so on up through the list of elements to the heaviest, uranium, which has 92 electrons describing orbits around a nucleus having 238 times the weight of the hydrogen neucleus. In each element the positive charge on the nucleus is exactly counterbalanced by the negative charges of the electrons.

In splitting up the atom and thereby liberating the tremendous electrical charge which it contains, the problem of scientists is to drive a projectile with enormous force and speed into these nuclear protons and break them up into two or more groups; that is, into two or more atoms, thus effecting a transmutation.

How "Guns" Bombard Atoms

Two types of "guns" capable of shooting electrical bullets into the nucleus of the atom have proved practicable on a small scale. In early experiments "radium guns" were aimed at simple elements like hydrogen, nitrogen, and lithium. Radium is constantly disintegrating, and in doing so it shoots out helium nuclei or alpha rays. These bullets were found quite capable of stripping off electrons from simple elements with few orbital electrons like helium and lithium, but they couldn't penetrate to nuclear protons of heavier elements like mercury and lead. In addition, this method of atomic disintegration proved far too costly. Results in liberated energy were not worth the price paid in radium.

Abandoning the radium guns, experimenters are now devising high voltage vacuum tubes to furnish the projectiles with which to penetrate the atomic nucleus. Most noteworthy among these experiments is the atom-smashing feats performed by two British scientists, Dr. J. D. Cockroft and Dr. E. T. S. Walton, who

have succeeded in splitting up an atom of lithium into two atoms of helium, thus, it is believed, inaugurating the era of atomic energy engines and foreshadowing the day when gold will be made from base metals.

The "gun" which shot the "bullets" to bombard the lithium atoms was a special vacuum discharge tube, operating at a potention of from 120,000 to 600,000 volts. This enormous voltage generates a stream of fast-moving protons which are directed along a glass tube in which a screen of lithium is placed. Traveling at a speed of 4,000 miles per second, these protons impinge on the lithium atoms on the screen and break up each nucleus struck into two helium nuclei.

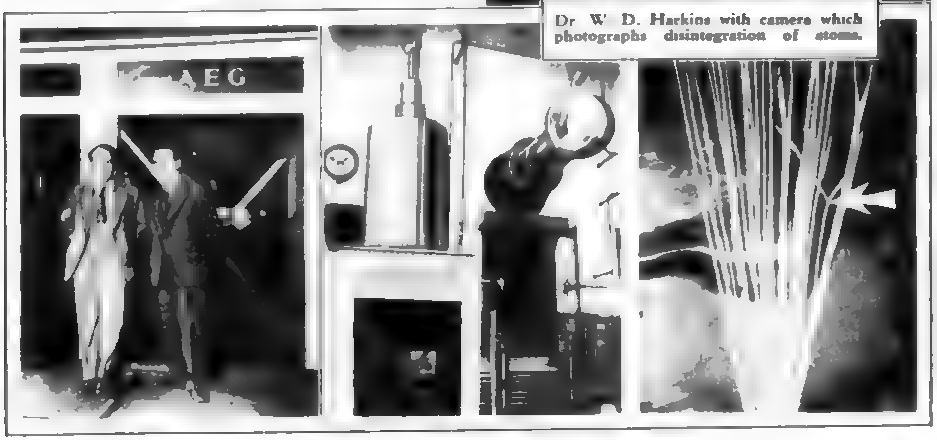
How Lithium Is Changed to Helium

The process of transmutation, illustrated in an accompanying drawing, was as follows: The lithium nucleus contains seven protons and four electrons. When struck by the proton generated in the vacuum discharge tube, an extra proton was added, causing the overloaded nucleus to split up into two parts, each containing four protons and two electrons. Now it so happens that this quantity of protons and electrons constitute a helium nucleus, so that two atoms of this element were created from an atom of lithium.

What is of immense interest to the world, because it points the way to the utilization of the power bound up in the atom, was the fact that for each atom shattered in the experiment, energy amounting to 16,000,000 volts was liberated. And this from an expenditure of only 120,000, to 600,000 volts—the potential at which the tube was operated. This 16,000,000 volts represents the energy liberated upon the breaking up a single lithium atom. The lithium atom has a certain weight, but the combined weight of two helium atoms is not equal to the weight of the former atom. The loss of mass, scientists deduce, represents the generation of the 16,000,000 volts. In the chronicles of laboratory experimentation upon the atom, nothing more startling has ever transpired.

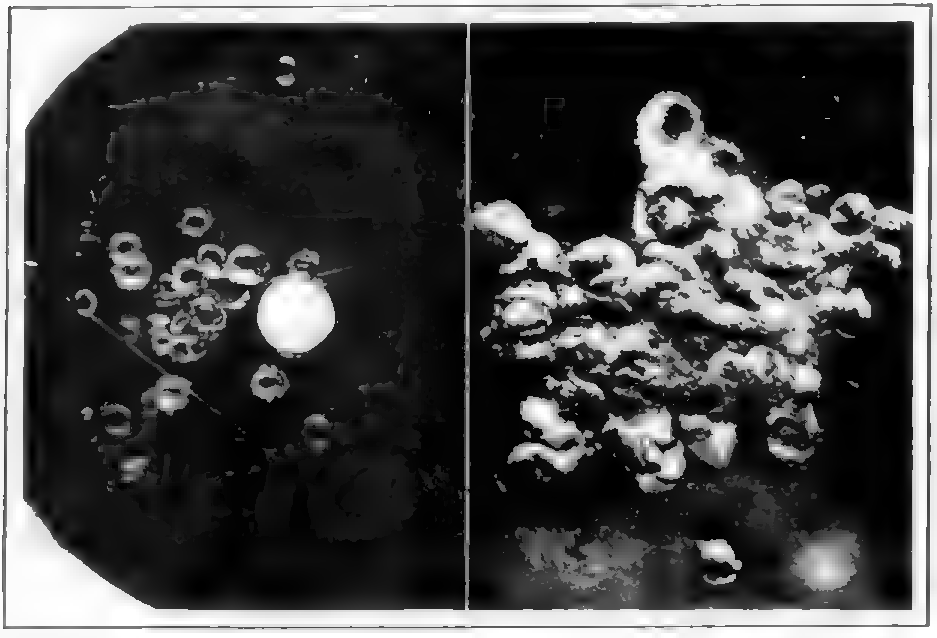
Successful as this astounding experiment was, there was a snake in the scientist's paradise. Bombard the lithium atoms as they would, they could succeed in making only one hit in each ten million protons fired from the high-voltage vacuum tube. Thus the energy is released only once in every 10,000,000 attempts a very low efficiency. But although the experiments did not succeed in unlocking the energy on a mass-production scale, they at least pointed the way to the goal.

Dr W. D. Harkins with camera which photographs disintegration of atoms.



At left are seen Drs. Brasch and Lange, German scientists, and laboratory in which they are said to have split up atoms of four elements—boron, beryllium, sodium and lithium. They produced energy equal to 10,000 kg. of radium, using current of 2,400,000 volts. At right is remarkable photo made at University of Chicago by Dr. W. D. Harkins, showing atom of helium colliding with atom of nitrogen mass. Arrow shows point where an atom was struck.

Scientists Building High Voltage Tube to Attack Cancer in Human Bodies



Power of the vacuum tubes employed by Drs. Brasch and Lange is demonstrated in this photo showing effect upon a sheet of brass of artificial beta rays generated by 2,400,000 volts. Small craters are eruptions of tin and copper when struck by electric particles. The Brasch-Lange tube will be used in cancer battle.

A tremendous stride towards the objective of unleashing the vast energies of the atom has very recently been taken in Germany by two eminent scientists, Drs. Fritz Lange and Arno Brasch. The advance made is indicated in the fact that where Cockroft and Walton succeeded in making one hit in ten million, the Germans pulverized millions of atoms, extracting four times as much atomic energy as was injected in electrical energy. Overthrowing all physical laws, the experimenters transformed aluminum into helium, and split the atoms of four other elements in addition—boron, sodium, beryllium and lithium.

Germans Building Super-Power Tube

Many eminent physicists hold the feat of atom-smashing to be epochal, a prelude to releasing the vast stores of energy held within the most minute particles of matter known to man. In addition, the day when base metals will be transmuted into gold is brought a day nearer. Not satisfied with their present accomplishment, the Germans have now under construction a super-generator which they hope will smash atoms by the billions.

Although details of the experiment is kept a closely guarded secret, it is known that the chief weapon employed in the attack upon the atomic nucleus was a 5,000,000 volt X-ray tube, operated at half power, or 2,500,000 volts. To an American physicist, Dr. Coolidge, of the General Electrical Co., goes credit for designing the tube, or rather tubes, for several are used together in cascade formation. This scheme is made necessary by the intensity of the rays, which penetrate even the insulation.

Swiftly upon the heels of this feat has come another piece of news which has set the scientific world agog. A young German scientist, Heinz von Bohndorff, hitherto unknown, claims to have actually made pure gold from mercury, thus realizing the ancient dream of alchemists.

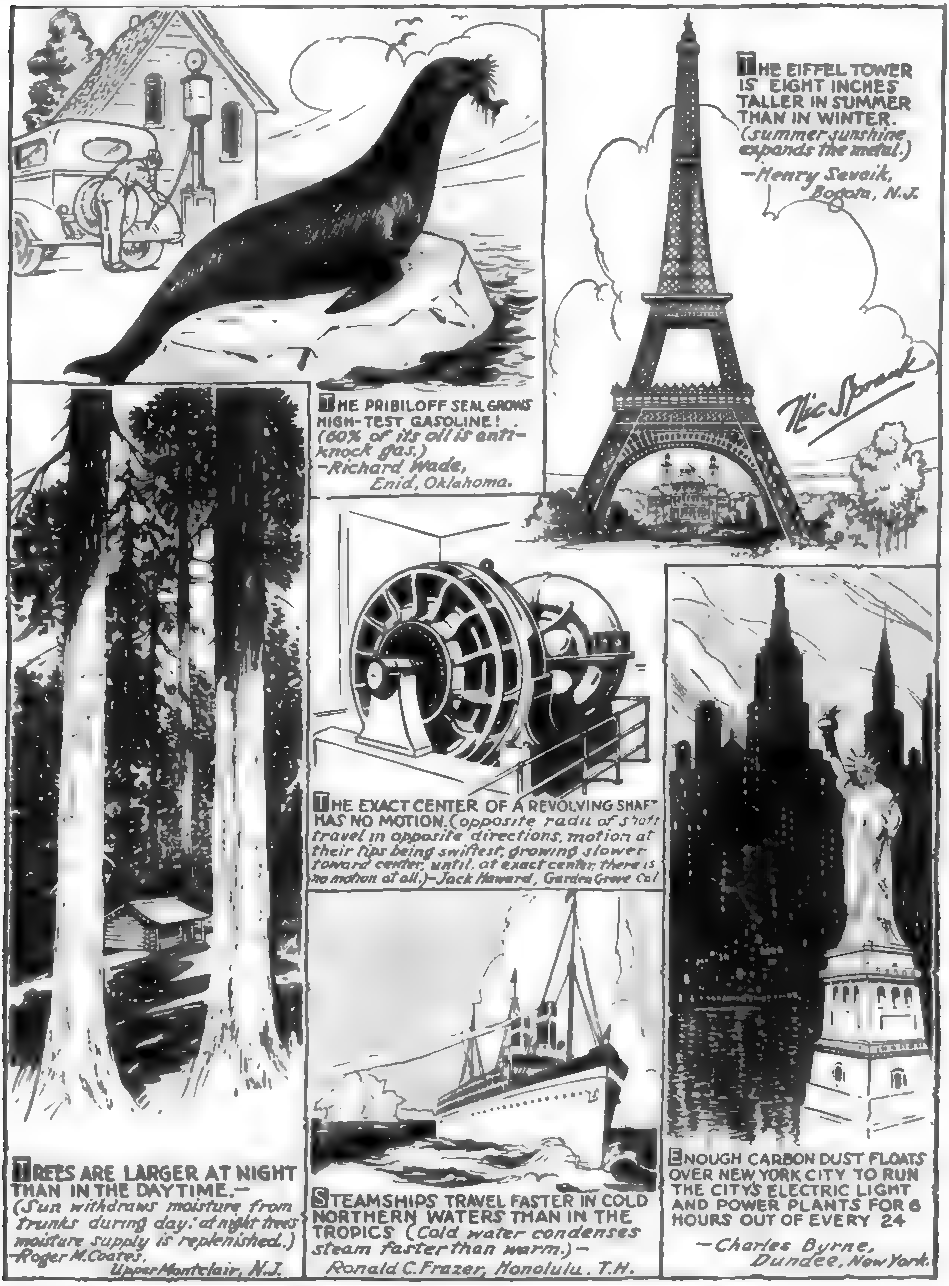
.0008 Grams of Gold Made From Mercury

This feat of transmutation was accomplished by the use of a million volt cathode ray tube, the current for the step-up transformer being furnished from ordinary house current. A quantity of mercury was exposed to a bombardment of protons from the tube for a period of forty hours, at the end of which time analysis revealed that each atom of mercury had been split into one of gold and one of hydrogen. A magnifying glass brought to bear upon the vial holding the erstwhile mercury revealed numerous glittering particles of the precious metal lying amidst a quantity of gray ashes. The weight of the yellow metal created was found to be .0008 grams.

A group of outstanding German scientists examined the gold and declared it genuine.

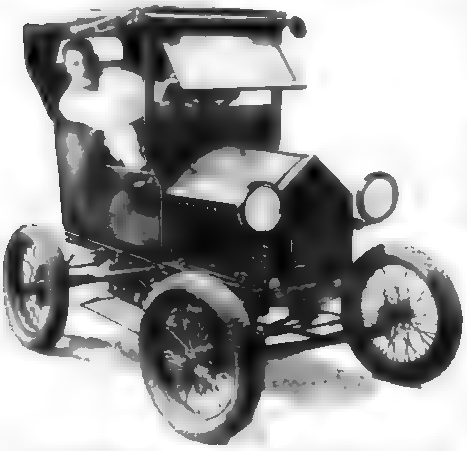
Oddities of SCIENCE

by NIC SPRANK



ONE DOLLAR will be paid by Nic Sprank for oddities of science used on this page. Send in your ideas—no limit to the number of suggestions you may make, but be sure to enclose proof of your statements. Maybe your ideas will be better than those shown on this page—if they are, Nic Sprank wants them and will be glad to send you a check. Address suggestions to Nic Sprank, care of Modern Mechanix and Inventions, 529 South Seventh Street, Minneapolis, Minn.

Tailor's Leg Cut Off—He Builds Auto for One-legged Man



An automobile for a one-legged man. Joseph Freedman, crippled Philadelphia tailor and builder of the car, drives entirely by hand, save for one pedal. A 2-cycle motorbike engine furnishes power.

WHEN Joseph Freedman, 44-year-old Philadelphia tailor, lost a leg in an accident, one of the greatest hardships he experienced was being unable to drive a car.

Then old "Mother Necessity" was brought on the job, with the result that Freedman designed and built an auto which is operated entirely by hand, save for one pedal. The car, seen at the left, is powered by a 2-cycle motorbike engine and goes anywhere on its two motorcycle and two airplane wheels.

Antiseptic Ice Sterilizes Drinks

ANTISEPTIC ice, said to be able to kill dangerous germs in any drink in which it is placed, although no chemical germicide is present, has been put on the market in Germany. Manufacture of the ice is based upon the sterilization process using colloidal silver for the water from which the ice is made. The germ-killing effect is ascribed to silver set free in the water from silver plated sands with which the water is brought in contact.

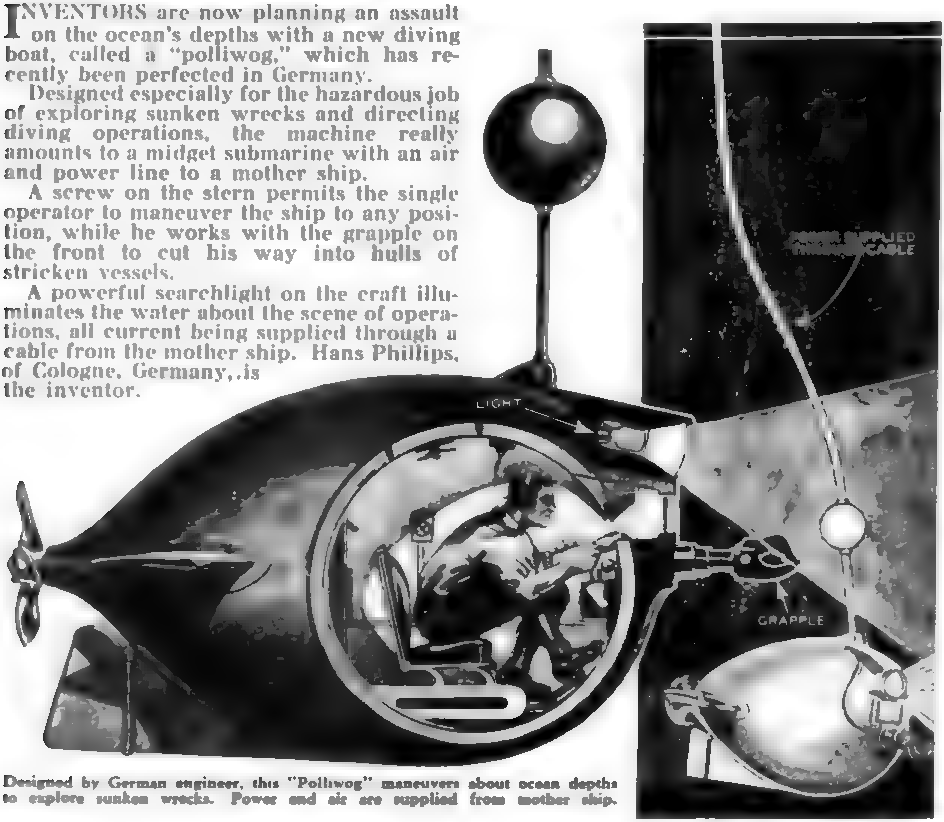
German Designs Midget Sub to Scout Ocean for Sunken Treasure Ships

INVENTORS are now planning an assault on the ocean's depths with a new diving boat, called a "polliwog," which has recently been perfected in Germany.

Designed especially for the hazardous job of exploring sunken wrecks and directing diving operations, the machine really amounts to a midget submarine with an air and power line to a mother ship.

A screw on the stern permits the single operator to maneuver the ship to any position, while he works with the grapple on the front to cut his way into hulls of stricken vessels.

A powerful searchlight on the craft illuminates the water about the scene of operations, all current being supplied through a cable from the mother ship. Hans Phillips, of Cologne, Germany, is the inventor.



Designed by German engineer, this "Polliwog" maneuvers about ocean depths to explore sunken wrecks. Power and air are supplied from mother ship.

Parachutes Save Victims Trapped in Burning Building

THE latest wrinkle for persons trapped in a burning building comes from Berlin, Germany, where there has been developed a parachute to take the place of the slow and cumbersome type of fire escape. The device has proven highly satisfactory wherever used.

The pictures on the right show a demonstration being carried out. The victim has just flung herself from a blazing room and is about to land. The mask, seen in the close-up, resembles the type used during the World war. It is fastened securely over the head before the leap into space to protect against smoke and to prevent the face from being scorched.

The photos above demonstrate how the parachute operates in delivering its users from a burning building to the safety of the ground. Note the mask in the close-up on the left which protects the victim from smoke and flame.

Diving Robot Samples Fish Food

A SUBMARINE robot that dives under the ocean and takes samples of animals and plants which fish feed on has been perfected in England. All that is necessary is to throw the robot overboard and allow it to follow like a rowboat in tow. The device has a wide-open mouth through which a stream of sea water is forced. Inside the body, a strip of closely woven cloth holds the sea particles.

It is a valuable contribution, inasmuch as good fishing grounds may be located by finding out where the sea food is most abundant.

Science Tests an Elephant's Pep

Scientists are here seen connecting the new oxygen apparatus with the trunk of a circus elephant preparatory to testing for the degree of energy it consumes when breathing.

A GROUP of scientists from the Missouri College of Agriculture tackled an enormous job when they undertook to measure the amount of energy of an active elephant. The feat was successfully accomplished by the use of the oxygen apparatus shown in photo above.

The results of the test revealed that the four-ton circus elephant consumed only twice as much energy as a horse weighing 1,600 pounds. This is really remarkable inasmuch as the elephant's weight is more than five times that of the horse.

Tear Gas Trap for Cash Registers

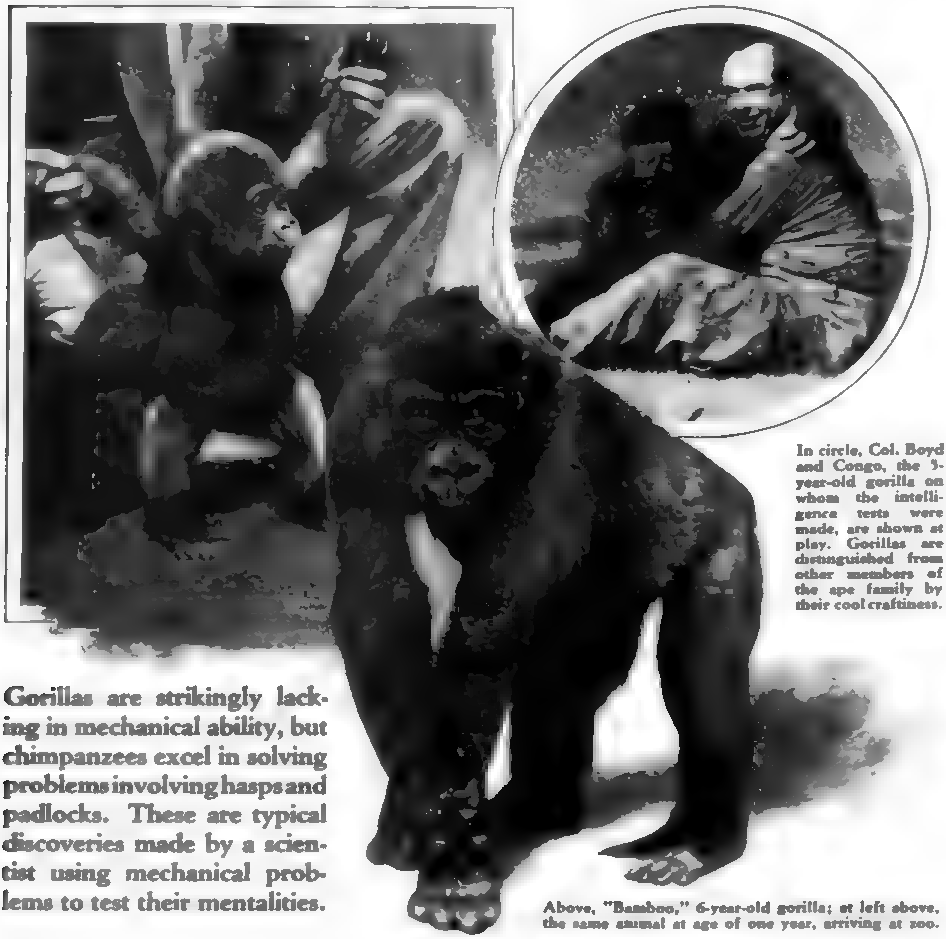
A NEW device used to spread tear gas has been invented for cash registers. It is called a "money trap" and discharges a dense cloud of gas into the thief's face when he tries to rifle the till.

Formed and painted to duplicate a dollar bill, the box-like compartment fits snugly into the cash drawer. Upon its face is a clamp under which the regular bills are placed. When these are removed, the tension on a spring loosens, allowing a lever to snap up and release the gas. It shoots out in a steady spray through an elongated slit on the face of the trap near the right hand corner. The victim is overcome and easily captured by the police.

In use, the "gas trap" is set each night before the proprietor retires. It also proves serviceable during the day, since it will blind a hold-up man.

The latest in tear gas devices. It is known as the "money trap" and fits into the drawer of a cash register. When bill is removed lever snaps up, releasing cloud of gas.

Mechanical PUZZLES Test



In circle, Col. Boyd and Congo, the 5-year-old gorilla on whom the intelligence tests were made, are shown at play. Gorillas are distinguished from other members of the ape family by their cool craftiness.

Gorillas are strikingly lacking in mechanical ability, but chimpanzees excel in solving problems involving hasps and padlocks. These are typical discoveries made by a scientist using mechanical problems to test their mentalities.

Above, "Bamboo," 6-year-old gorilla; at left above, the same animal at age of one year, arriving at zoo.

GORILLA. King of the Great Apes! What are the facts regarding this largest and strongest member of the ape family? Is he as clever as he is reputed to be? Or is he, as some charge, all brawn and no brains? How does he measure up mentally with the chimpanzee and the orang-utan?

Today, thanks to a professional student of animal behavior who used ingenious mechanical problems in a series of studies which are unique in the annals of scientific research, we have authentic answers to those questions.

The person who reveals the ape-king to us in a light heretofore unknown is Dr. Robert M. Yerkes, of Yale University. He is the directing head of the new laboratory and primate quarters at the Yale School of Medicine. He is also in charge of Yale's anthropoid breeding and observation station established at Orange Park, Florida.

Congo, a five-year-old female specimen of mountain gorilla, was the subject used by Dr. Yerkes in his studies. She was but a child gorilla, it is true, but no man lives who has captured alive and subdued an adult gorilla. Neither has man, despite all his knowledge of animals, succeeded in raising a gorilla to maturity. Indeed, the world has yet to hear of a baby gorilla born in captivity! So Dr. Yerkes considered himself fortunate in having a specimen as old as five years placed at his disposal for study.

With the Florida out-of-doors as a laboratory, Congo was studied for three winter seasons by Dr. Yerkes and his staff. A large number of novel problems were set for her, by means of sticks, ropes, chains, bottles, boxes, a mirror and other appliances. The experiments began at 9 in the morning and

APE'S Intelligence

by CHARLES W. PERSON

The photo above shows Congo at rest after a particularly trying experiment. Note the almost human posture—faintly reminsdful of a laborer reclining after a hard day's toil.

Congo listens to her image in a mirror, grasping the frame with her powerful hands to shake some response out of it.

Chimpanzee, at left, with young gorilla. Chimpanzees are playful, energetic, and tire easily; gorillas are calm, with great reserve of strength, and betray very little curiosity.

continued until 2 in the afternoon. Four foods were used as rewards or lures—baked banana, baked sweet potato, raw apple and orange.

In most of the problem situations Congo worked hard to appease her appetite. She wasted little energy and exhibited, as has not been observed in any other ape, keen appreciation of and regulation of behavior in accordance with the value of the reward and the probability of obtaining it. While working in her cage on the tests, the animal was given full freedom, although a leather collar was always kept about her neck. When taken out of her cage her freedom was restricted by a stout chain.

"Does the gorilla know how to use the stick as a tool?" was the first question Dr. Yerkes wanted Congo to answer. Accordingly, he erected a wooden shelf, equipped with guard rails to prevent the food from slipping off, and placed it adjacent to the animal's cage. A banana was placed on the shelf at a point beyond her reach and three sticks were put in her cage, any one of which she could have used to reach the food and draw it to her. For one hour each on three occasions Congo struggled hard by means of feet and hands to reach the food. She ignored the stick, trying by sheer strength to wreck the cage and seize the banana. Not until many tests later did she realize what she could do with the stick. Thereafter she used it with telling effect.

Food Used as Lure

Food was then suspended from a tree and Congo was handed a stick to knock it off. It was quite some time before she mastered this simple problem. A short stick was then given to her. She was expected to use this to obtain a longer stick with which she could secure the food. Skill in putting this idea into effect also developed slowly.

In another experiment Congo saw a banana placed inside a pipe. A stick was laid alongside the pipe and it was thought she would promptly use it to push out the banana. She was slow to grasp this idea, however. Dr. Yerkes then submitted to her a box and pole problem. Food was suspended from a tree and nearby lay a box and a pole. After a large number of trials

Food was used as a lure in all these simple mechanical tests. In the top photo, Congo is manipulating a rod, seeking a way of recovering a banana in the pipe. Surprisingly, she was slow to find the correct method. In center, Congo is trying to raise a pile of boxes to reach a bit of food suspended from a tree. Bottom photo, a chimpanzee who had no difficulty in removing a snap and opening the box containing a banana, which he is contentedly munching. This problem was too complicated for the gorilla, who didn't even try to solve it after deciding that it couldn't be done. The chimpanzee ranks first in mechanical ability.

Congo conquered this problem, moving the box under the hanging food and then striking it down with the pole. This same problem had been solved by the orang-utan and chimpanzee quickly and apparently with ease.

Summing up results of the various stick and pole problems, Dr. Yerkes says that Congo at the beginning of observations possessed very little ability to use sticks as implements. Such ability as she did acquire came as the result of suggestion, imitation and direct aid. In degree of manual skill employed, Dr. Yerkes concludes that Congo was inferior to the orang-utan and chimpanzee of the same age and experience.

In the next series of experiments Congo was introduced to simple mechanisms such as a hooked rope, a milk bottle containing food or milk, a turntable with cans, and boxes fastened by hasp, padlocked and spring snap. It took two seasons of experimenting before the gorilla made good progress in securing solid food from the bottle. By contrast, the chimpanzee mastered this experiment much quicker.

At no time, says Dr. Yerkes, did Congo exhibit skill in the manipulation of hasp and padlock comparable with that of the chimpanzee. As a matter of fact, the gorilla's responses to mechanisms were inferior to those of the chimpanzee. In other words, the gorilla, in common with many humans, is not mechanically inclined, whereas the chimpanzee is.

Of particular interest were the tests involving the use of boxes in obtaining suspended food. At first Congo had to use two boxes, one placed on top the other, to reach her reward. Then the food was placed much higher and she had to use four boxes to reach it. The first season she succeeded fairly well in this experiment and the year following she did it with ease. It was only in the four-box test—a difficult one for any animal—that she was given any aid.

To measure her memory, food was placed in a box and this was buried, while Congo, eager to eat some of it, looked on. The animal was then removed some distance and requested to locate the food. In this test she proved

to be proficient. Dr. Yerkes reports that in memory the gorilla compares more favorably with the chimpanzee and orang-utan than in speed and ability to adapt herself to the various experiments.

Many other situations were devised to throw additional light on Congo's behavior. Some of these revealed that in the matter of curiosity she was below the normal level of the chimpanzee.

"When Congo might inspect, test or observe an unusual object in a few ways," explains Dr. Yerkes, "the chimpanzee would do so far more persistently and with greater versatility. Often where one would expect the keenest curiosity Congo appeared indifferent. This is strikingly different from common experience with the chimpanzee, which eagerly imitates man as well as members of its species."

At once less an investigator and less imitative than the chimpanzee, Congo, it appears, was less willing or eager to work hard in the face of discouraging conditions. Eager and optimistic in the first stages of work on a problem, she tended after a time to abandon it unless she achieved a measure of success. Otherwise expressed, the gorilla, like not a few humans, roughly measures or estimates the probability of success and if the chances seem to be against her, gives up the task. What at the start appears to her impossible she will not even attempt.

"Herein," observes Dr. Yerkes, "appears what may be one of the most important differences between the gorilla and mankind, for whereas Congo either refused to work or shortly abandoned effort in situations which must have seemed to her impossible of solution, some men commonly stigmatized as foolish, eagerly and insistently strive for what is unpredictable. This may be not only the most important difference between man and other organisms, but also the secret of human progress and the key to the development of human types of civilization and culture.

"Certainly if no representatives of our genius were willing to attempt the impossible, and even to devote their lives to a goal which may be generations distant, progress would be relatively slow."

In top photo, Congo tried to tear her cage apart before she learned that she could push the food toward her with the sticks. In center, an experiment in delayed response, to determine how long it would take her to free herself from the chain. She proved quite slow as compared with a chimpanzee, and to judge from her expression resents the inference of inferiority. Bottom photo shows Congo on the job in the slot-box experiment. One end of the box was closed, but by using a stick in any one of three slots the gorilla could remove the food and solve the test. The gorilla was only five years old when taking these tests.

Chimpanzee Quickest, Gorilla Most Deliberate of All the Great Apes

Big game hunters who have invaded the forest home of the gorilla report that the animal is fearless. Dr. Yerkes' experiments seem to confirm this observation.

"Not once," he reports, "did I observe anything remotely approaching terror or rage in Congo. She exhibited no real fear of any person or object. All of my efforts to induce anger failed to elicit any expression. Naturally I thought that sufficiently disappointing or exasperating situations would induce in this animal the temper tantrums or violent expression of displeasure natural to child and chimpanzee alike. But such was not the case.

Gorilla Simulates Indifference

"On the one hand, this mightiest of apes was naive and stupid, and on the other unexpectedly deep, far-sighted and given to the practice of craft and cunning. The longer I observed her and the more intimate I became with the nature and conditions of her behavior the more I suspected that her apparent stupidity was grossly misleading.

"It was her nature apparently to act as though somewhat indifferent to situations which would arouse the interest of other types of primate. Not only was she silent where one might expect vocal expressions of feeling, emotion or mood, but she was seemingly stupid or inapt in situations which the other apes promptly mastered."

Chimpanzee Most Playful

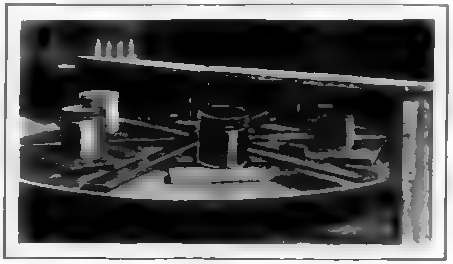
In drawing contrasts between the three types of apes, Dr. Yerkes says he has found the chimpanzee to be sanguine, the orang-utan melancholy, the gorilla reserved.

"The chimpanzee," he states, "is the leader of the manlike apes in playfulness and invention of ways in amusing itself. It is quick, impulsive, energetic, but like persons of extreme optimism and enthusiasm tends to fatigue rapidly. The orang-utan, working more slowly and cautiously, makes one feel it is somewhat more stable and dependable than the chimpanzee. The gorilla, calm, reserved and apparently cool and calculating in its attack on problems, seems almost the opposite of the chimpanzee.

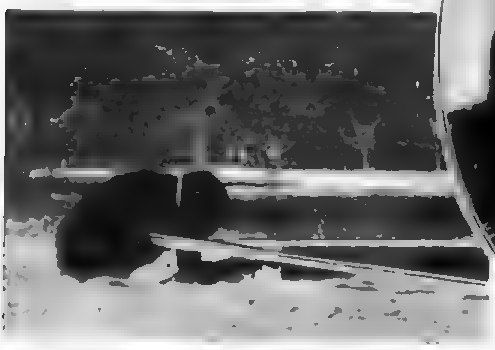
"Contrasted on the basis of curiosity the chimpanzee heads the list, the orang-utan is second, while the gorilla usually acts as though it considered itself superior to such childish expressions. This was one of the things that continually impressed me as I observed Congo.

"In order of their ability to acquire new knowledge and habits the three types rank: chimpanzee, orang-utan, gorilla. But when it comes to ways of profiting by experience which turn on deliberate examination of the surroundings and such processes as

(Continued on page 156)



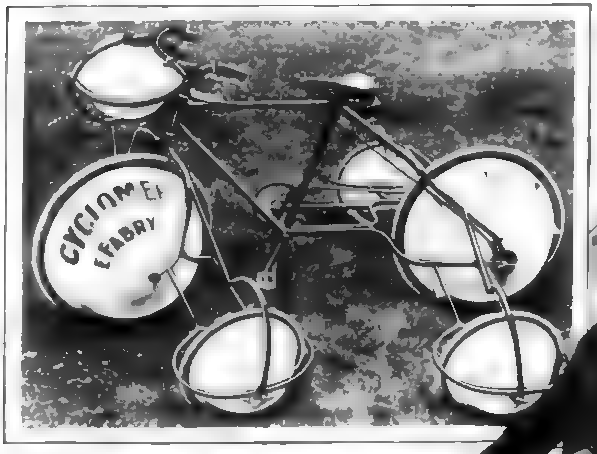
Turntable test apparatus. Food was placed in a certain can and Congo was timed to see how long it would take her to bring the can into proper position and remove the food.



Congo had difficulty mastering the box and pole problem, in which a long stick was used to poke food through a box.

Face of a gorilla. A full grown adult gorilla has never been captured alive because of its ferocity and strength.

Land or SEA BIKE is Queer Contraption



Here's a new amphibian vehicle which scoots across land or water like six-legged bug!

For riding on land, the Cyclomer can either be used as a six-wheeled vehicle, as above, or as an ordinary bicycle as shown at the right.

NOW you can make a bicycle journey through any sort of unsettled territory, and when you come to an unbridged river you won't have to stop and build a raft, but can go ahead and paddle across the water with all the confidence of a Mississippi paddle wheel steamer.

A queer-looking contraption known as the "Cyclomer" makes all this possible. It is the invention of a Parisian, E. Fabry, and as depicted on the cover of this month's MODERN MECHANIX AND INVENTIONS and in the photographs above, resembles an ordinary bicycle to which four balloon outriggers have been attached.

Each of the spheres acts as a wheel and wears a rubber tire around its middle. When traveling on land the outriggers are lifted up at a 90-degree angle so that the rider is surrounded by them on all sides. If desired, the Cyclomer can be pedaled on land with the outriggers down, but this is feasible only when a wide roadway is at one's disposal.

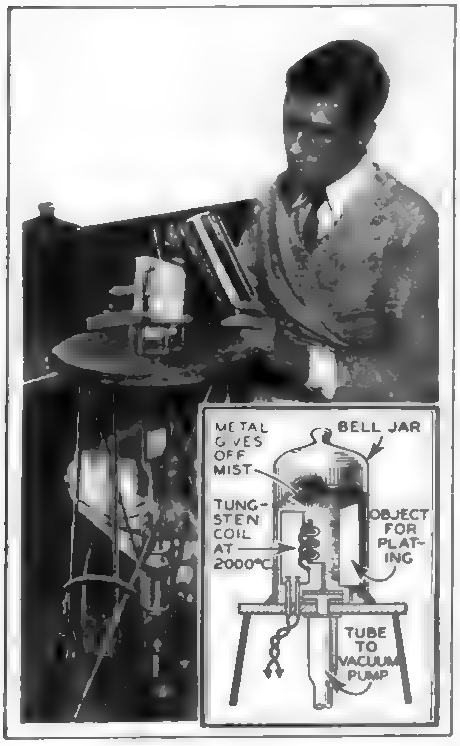
Triangular vanes on the rear wheel act as paddles when the vehicle is in the water. The front wheel and its two satellites both move when the handlebars are turned, the sharp edges of the tires acting efficiently as triple rudders. The wheel pontoons are completely water tight, constructed of light metal.

Each of the six rubber tires of the Cyclomer is fitted around a hollow sphere, acting as a wheel, which gives buoyancy.

Fingerprints of Tree Leaves

FINGERPRINTS of tree leaves, made exactly as detectives make fingerprints of suspected criminals, are suggested as an interesting hobby for collectors and amateur scientists. Leaf prints may be made on strong, stiff paper and will last forever. To make a leaf print, the collector needs a plate of thick glass about a foot square, a tube of printer's ink, a small rubber roller, and the paper on which the leaf prints are to be preserved. A small amount of the printer's ink is put on the glass plate and spread into a uniform film with the rubber roller. The leaf then is placed, vein side down, on this ink film, covered with newspaper, and rolled with the rubber roller. It then is transferred to a sheet of clean paper, again covered with newspaper and rolled with the roller only once.

"Metal Mist" Device Gold Plates Objects in Vacuum



Piece of cloth on table has been mist plated with gold in device whose operation is explained by the inset diagram.

HOW would you like a gold-plated suit of clothes or platinum plated wall paper for your home? These are well within the range of possibility, following the development of a "metal mist" plating method by Dr. John Strong of the California Institute of Technology.

The object to be plated is placed under a bell jar in which a vacuum is created. The metal to be used in plating is placed inside a coil of tungsten which develops such terrifically high temperatures when electric current is sent through it that the metal dissolves into a mist, like steam, and deposits itself on whatever is inside the jar. Silver, copper, tin, gold, platinum, or any of the metals, including aluminum, may be used. Plating of a thickness of only 1/100,000th of an inch has been successfully done by this method. The mist is only possible when the heat is applied in a vacuum.

Geology May Affect Cancer

THAT one's chance of getting cancer may be affected by the kind of rocks underneath the country where one lives, perhaps because these rocks control the kinds and quantities of mineral elements in the drinking water, is indicated by comparisons presented to the French Academy of Sciences by F. Blanchet and L. Bethoux.

Taking the French statistics of death causes for two different years, 1920 and 1931, these savants assembled figures for cancer deaths in fourteen administrative departments of France which happen to be located on rocks composed of chalk, sandstone and other sedimentary materials, and compared these with the numbers of deaths from cancer in eight other departments of France the underlying strata of which are granites or other rocks formed by the action of heat. In the two years noted, they find, there were more than twice as many deaths from cancer, in proportion to population, in the regions underlaid by sedimentary rocks as in those underlaid by granitic ones.

The effect is probably caused by mineral elements dissolved in drinking water.

Home Ice Cooler for Hot Weather

A COOLER for keeping hot weather temperatures bearable within the home has been brought out which is built in units, like a sectional bookcase, adjustable to the requirements of various sized rooms. Each cylindrical section holds 75 pounds of ice, and as many units as may be required are piled on top of each other. The base section admits air from the room which is sucked up over the ice by an electric fan at the top, so that the air is cooled and circulated through the room. For demonstration purposes ribbons were attached to the top of the cooler, as shown in the photo below, to prove the effectiveness of the fan in keeping the air flowing.

Each cylindrical section of this cooler is filled with ice, over which air is drawn by fan to keep temperatures comfortable.

What Old Mother Earth Looks Like From Ten Miles Up

Taken from ten miles over the Italian Alps, this photo shows how the earth appears to a voyager in the stratosphere.

FOR the first time in history a photograph of the earth has been made from the stratosphere, that cold, attenuated layer of atmosphere ten miles above the ground. The photograph above, showing just how wrinkled Old Mother Earth appears to the eye of the aeronaut, was taken by Prof. Auguste Piccard on his recent balloon flight in which he ascended 54,120 feet—more than 10 miles.

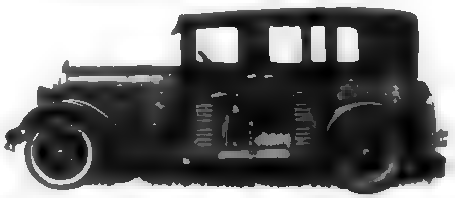
The photograph was taken straight down as the gondola floated over the Italian Alps. The white streaks are the drag lines of the balloon, while the circle in the center, looking like a ring, is the antenna of the balloonists' radio. Some 48,000 feet was the height of the balloon at the instant this picture was snapped, making this the first time that a photograph has been taken from such a height. The gigantic mountains look like pygmy sections from a relief map.

Tear Gas Gun for the Wrist

A TEAR gas gun effective enough to rout a gang of payroll bandits and small enough to be concealed in a coat sleeve has been invented by Elmer Carlstrom of Chicago, a retired policeman. The gun is worn strapped to the wrist, as shown in the photo below. A piece of catgut, flesh colored and invisible at a glance, is stretched between a ring on the wearer's finger and the trigger of the gun. The hand can be moved freely in any normal position, but bending the wrist sharply will discharge the weapon. Leather under the muzzle protects the wearer's arm from being burned by discharge of the gas.

Bending the wrist sharply pulls a length of invisible flesh colored catgut which discharges the tear gas pistol.

Traveling Comfort for the Dog



In their own private compartment which fits neatly on the running board, dogs are carried comfortably on motor trips.

ANYONE who has ever attempted a long motor trip on which a large dog was taken along will appreciate the "Bird-dog's Palace," recently placed on the market.

Made of sheet steel, insulated inside so that the animal will not come in contact with the metal, the "Palace" is so constructed that it may easily be clamped to the running board without marring the finish of the car. The barred door slides upward, permitting the dogs to be released without the driver having to leave his seat. An oil-cloth cover may be unrolled and buttoned into place if the weather is bad or the road dusty. The "Palace" is made in several sizes to accommodate all kinds of dogs.

Two Chairs make Gymnasium

Don't hibernate during the winter. Keep up your pep with these muscle-

Two months of daily exercise in the chair gymnasium will develop your muscles to size and suppleness shown here. Persistency is the chief requisite.

Developing abdominal muscles. Standing between chairs, touch fingertips to floor and return to upright position.

Develop your thigh and shoulder muscles by resting palms of your hands on backs of the chairs set back-to-back as illustrated in the photo at the right. In this position slowly raise and lower the feet from the floor until you're good and tired. In performing the exercises choose chairs with curved backs, and with legs as wide apart as possible to prevent danger of slipping on the floor.

Here's how to work up some powerful arm and shoulder muscles. With your knees clearing the floor raise and lower yourself as many times as you can.

Another exercise for shoulder development. Work your feet as if racing, with hands supporting all your weight.

Strengthen back muscles by raising and lowering the middle of the body.

to Build Powerful Muscles

building exercises which require a gym consisting only of two chairs.

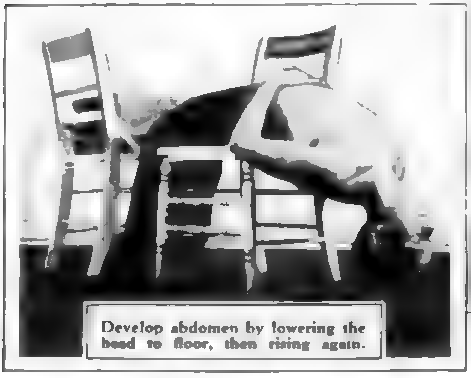
WANT to develop a set of muscles that will be the envy of all your friends? Strengthening your arms, shoulders, back, abdomen, thigh and leg doesn't require an elaborate gym, but only two chairs and a little persistency. Go through these exercises daily for a period of two months and you'll have strength to burn and your pep won't flag during winter months. Work out at least fifteen minutes each day.

How would you like to have a set of back muscles like this? Exercises shown on these pages take off *excess* flesh and put on hard muscle in its place.

Give your right arm muscles a workout by raising and lowering middle of body. Then turn to the left side.

This exercise will give you command of a hefty set of shoulder muscles. Flex and straighten out the arms with remainder of the weight on the toes.

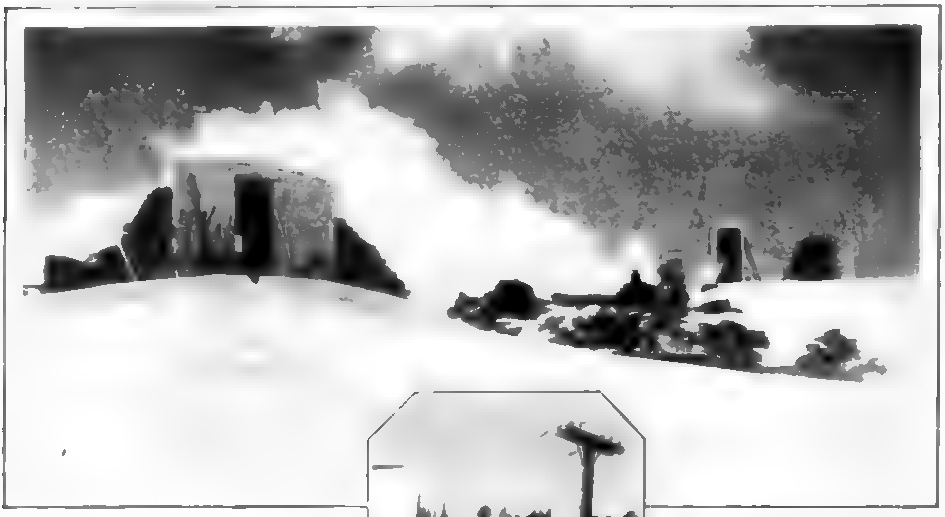
With chest up, lower the body as far as possible, then return, repeating exercise till tired.



Develop abdomen by lowering the head to floor, then rising again.

Working excess flesh off the thighs. With hands on chair seats, raise and lower the feet as rapidly as possible, as if running at your top speed.

Scientists "STEAL SNOW"



Meteorology station, typical of those from which the snow thieves work, on a mountain height.

Snow thieves setting out for the day's work, carrying the sampling tubes with which their measurements are made.

Snow in the high mountains frequently drifts so deep that the snow thieves leave their houses through the attic windows, as shown in this photo.

Power companies and farmers send out scientific thieves each winter to steal snow from Western mountain tops. Using ingenious sampling instruments, the "snow thieves" are able to estimate with surprising accuracy the amount of water that will run off in the spring to operate power plants and to fertilize farms.

SCIENTIFIC thieves, stealing samples of nature's white mantle high in western mountains, save millions every year for ranchers, cities and power companies.

How? They measure the water content of the snowfall, determine its depth and thus learn when and in what quantities it will melt and flow down fertile valleys to the Pacific ocean.

For nearly 10 years Prof. J. E. Church of the Nevada Agricultural College has been experimenting with hollow sampling rods and scales of measurement, seeking some infallible method of weighing heavy snowfalls. Today scores of "snow thieves," treading several hundred snow courses, take cores and send their reports to central bureaus where experts determine next spring's runoff.

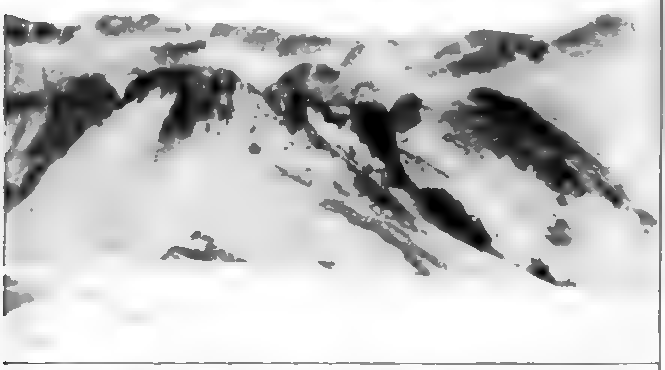
So accurate are their forecasts that the runoff at Lang's Crossing on the south fork of the Yuba River, California, one recent year totaled 361,000 acre feet as compared with the estimate of 369,000! One other estimate of 155,000 compared with the actual flow of 157,000 feet!

What makes the snow thieves' work so important is the increasing demand each

for POWER *Plants*

by JAMES BOWLES

Closeup of the snow sampler which is pushed down through the drifts, collecting a snow core which is weighed on the scales shown. Slots in the sides enable different densities of snow to be observed and facilitate poking out the core after weighing. The tube is aluminum, built up of sections screwed together.



Welfare of millions of people depends on snow drifting in mountain peaks like [illegible]. Runoff helps raise crops on farms and turns the wheels of power plants. The photo at right shows a snow surveyor alongside a deep mountain drift.

year for electric power and water for irrigation. Power companies need to know how much water will be available to turn their generators in mountain power houses. Farmers demand they be told whether they'll have enough water to grow their crops, and when it will arrive.

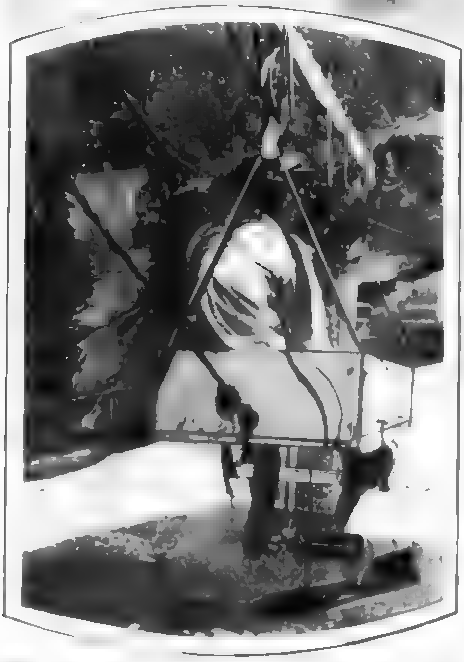
These things the mountaineers learn as they cover daily their snow courses and plunge the samplers down to earth.

Prof. Church, known as the father of snow surveying, commenced his studies at the Mt. Rose weather observatory, 10,800 feet above the sea in Nevada. In the tiny rock and wood shack he spent many winter nights pondering the problem of snow and experimenting with hollow tubes. At last he produced the Mt. Rose sampler, in common use today.

With the sampler, a snow thief, equipped with a pair of scales, a wrench, a rod from which to suspend the scales and a tape measure, can haul up from a heavy drift a core 25 feet long. Since the courses are selected in valleys where snow seldom falls to any greater depth, they always are assured of a complete sample.

Often in the face of death these hardy men, on snowshoes or skiis, skim over mountain tops. With their delicate instru-

This man is using a portable instrument to measure the amount of water flowing in a stream. The vanes, visible near his knees, are revolved by the current and act as a speedometer for the water flow, registering its swiftness.



This instrument, resembling an airplane bomb, is being used to measure the flow of a mountain stream by the scientist suspended in the moving carriage over its waters.

ments they crawl along frozen trails in four states California, Oregon, Washington and Nevada. But how are these lonely observations turned to practical good?

I carried the question to Dr. Geo. F. McEwen, University of California oceanographer who, for several years, has been studying the water cycle—from ocean to clouds to rain or snow down the streams to the ocean again.

"It is important to recall," he said, "that only nine-millionths of the ocean's water rises into the atmosphere, and if the salt in the ocean should be separated from the water, the salt would form a layer nearly 50 yards deep over the whole surface of the earth.

"The volume of water in the sea is 11 times that of all land above sea-level and is approximately one eight-hundredth that of the earth.

Snow Is Dormant Power

"Since large volumes are lifted from the ocean by evaporation, it is necessary that they be returned in some manner to the ocean. Otherwise the earth eventually would be covered by water and the oceans would become salt beds.

"Here, then, the snow finds its part in the picture. After it precipitates in the highlands, it lies dormant, sometimes several months, then evaporates, pours down streams, creating electricity and watering crops and supplying drink to animals and humans, on its way to the sea.

"Thus snow assumes an increasingly important role in the completion of the water cycle. So important, in fact, that now the American Geophysical Union has created a Committee on Snow Surveys to undertake more comprehensive studies. Snow surveys have been undertaken, especially in the West, because agriculture and electric power for industry depend upon a controlled water supply. Effects of heavy or light snowfalls are far-reaching, touching millions of people.

How the Thieves Work

"Suppose another million people settle in the West. They take up additional acreage, either directly or through their food requirements. More land goes under cultivation, requiring more water and cheap

power. Where does it come from? Largely from the snow. For that reason the 'snow thieves,' as you call them, turn their faces to the winter storms and record in their little brown books the story of the snow."

But how do the snow surveyors work?

Here Professor Church enters the story again, for it was he who fostered all this development, made it possible for Pacific Gas and Electric Co. engineers, principal sponsors of these surveys in California, to say with uncanny accuracy in mid-winter how much water will pour through their power houses in late spring and summer.

Developing the System

Professor Church, after his early experiments, saw it would be necessary to take the samples at exactly the same spot several times each week if the system were to prove accurate. Accordingly, he went into the western mountains in mid-summer, months before snow would fall, and laid out a series of experimental courses.

That winter the surveyors followed these courses. Results proved so surprisingly accurate that now the system is universally followed.

Each year additional courses are laid out. An experienced surveyor, possibly a lineman for some electric company, studies his particular watershed thoroughly. Then he sets out a series of stakes bearing yellow-striped, square signs.

Snow Cores 25 Feet Long!

Each of these marks the head of a course. To find the spot where a sample shall be taken, the surveyor in winter merely measures the specified distance with his tape, plunges down the sampler and procures a core.

In the "old days" the snow's depth and water content were determined by catching the snow in an open pan on a high platform, free from drifts. Then the snow was melted and the water measured.

Now, however, the "thieves" weigh the snow as it sways in the tube, suspended in a cradle of piano wires.

Through narrow slots in the side of the tube the surveyors can see the white column; through them, also, they may insert small tools to clean the mass out.

Since the tubes are made of aluminum they offer little extra weight as the men toil across mountains. In early autumn, a single five-foot section serves the purpose and as snow drifts increase in depth during the winter additional lengths are screwed together until a total of 25 feet are available.

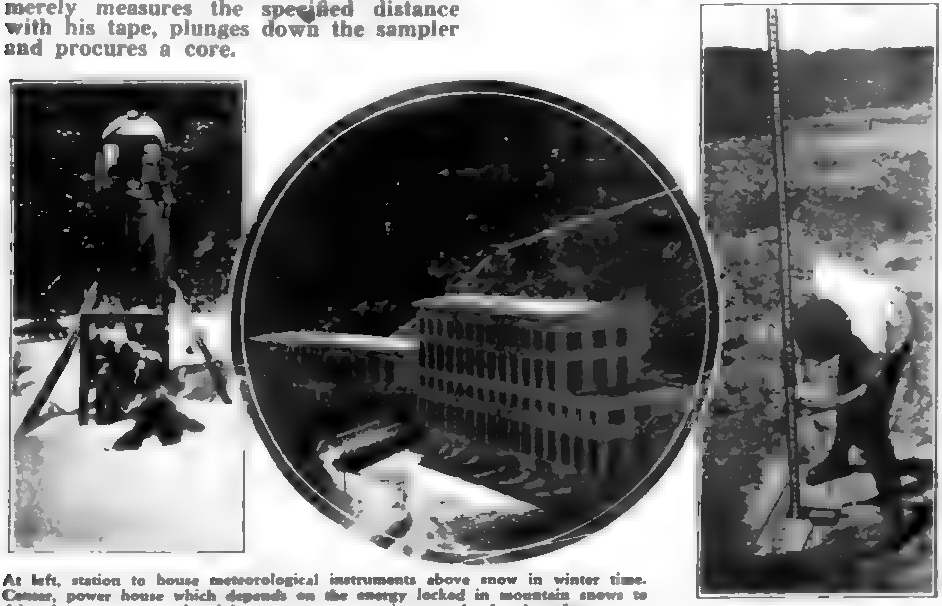
Taking the Core

To take a sample, the surveyor need only push the rod down, or screw it with the wrench into the lower depths. A serrated cutting bit, slightly larger than the tube, eats its way to hard earth. So well does the sampler work that samples as long as 234 inches have been taken, while the thermometer registered 21 degrees below zero.

Not infrequently, after a particularly heavy snowfall, cores of 20 feet are stolen.

No matter how heavy the storms the surveyors must cover their courses for their records must be kept without interruption. Commencing with selection of

(Continued on page 158)



At left, station to house meteorological instruments above snow in winter time. Center, power house which depends on the energy locked in mountain snows to drive its generators. At right, surveyor measuring stand of sub-surface water.

Boat-house on Canoe Dock Built Out of Pick-up Material

The small boat-house shown in the photo above was built entirely from pick-up material with the exception of the roof, which was made of purchased paper shingles.

REALIZING it was an inconvenience to carry paddles, seat cushions and other items of the sort back and forth from his home, an Ohio aquatic enthusiast set about to erect a small boat-house upon his canoe dock where he could store these articles in safety.

The attractive building seen on the left is the result. It is constructed wholly of pick-up material with the exception of the roof. Paper shingles were purchased for this.

The little boat-house compares favorably with many small homes. Among other things, it has windows, curtains, fireplace, and overhung porches. It cost very little and took but four days to build.

The clever little storage room has become a rendezvous for neighboring youngsters and the owner permits them to "play house" in it whenever he is about.

Sea Lions Fed From Slot Machine

A SLOT MACHINE that automatically throws a piece of fish to the sea lions whenever a person contributes a sixpence is a recent addition to amusement devices at the London, England, zoo.

Visitors enjoy the antics of these animals very much and donate freely to the machine. It feeds the sea lions while at the same time making a small profit for the owners.

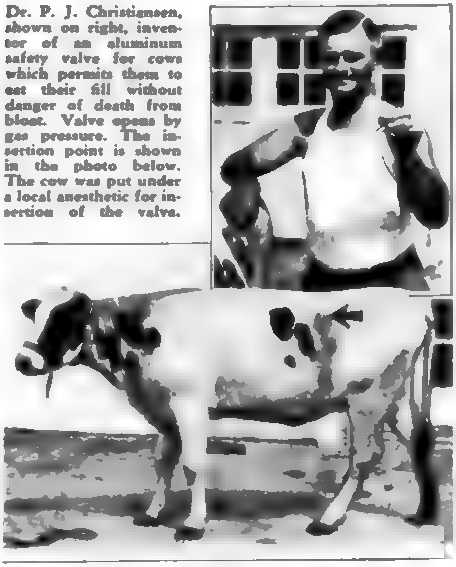
Tin Can Orchestra Makes Money

Sixteen various sized cans make up "orchestra" shown above.

THE tin can orchestra shown in photo on left was the invention of three New York boys who determined to beat the depression. Sixteen cans make up the orchestration. All are grouped according to the sound they emit. It is hardly exact to say they built a perfect chromatic scale but they have gone as far as possible with the materials at hand. One of the three boys plays the band while the others sing.

Safety Valve for Cow's Stomach

Dr. P. J. Christiansen, shown on right, inventor of an aluminum safety valve for cows which permits them to eat their fill without danger of death from bloat. Valve opens by gas pressure. The insertion point is shown in the photo below. The cow was put under a local anesthetic for insertion of the valve.



A NEW mechanical relief for the farmer and dairyman is an aluminum cylinder safety valve for cows which relieves dangerous gas pressure. It is inserted in the side, and permits the cow to eat its fill with no danger of death from bloat.

The safety valve consists of a cap cylinder of aluminum with a flange at either end. With a local anaesthetic, a round incision is made in the left side of the cow at the point indicated above and the valve inserted.

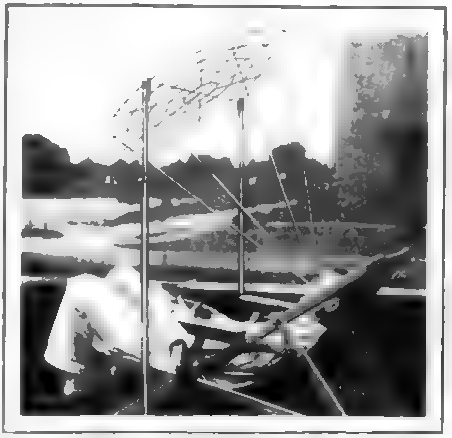
The internal part of the cylinder contains a ball and spring, but is displaced by gas pressure. After the gas escapes, the ball returns to its place. The whole operation is a mere matter of a few seconds.

Path of Perseid Meteors Is Charted With a Strange Device

ARE you wondering what the man in the photo at the right is doing? Well, he's giving an exhibition of how properly to view Perseid meteors as they hurtle through space.

The wire framework which seems to originate at the observer's eye is called a reticle, and its job is to permit the stargazer to chart the course of the meteors. The upper concentric circles of wire and the aperture at the lower end are focused on some part of the sky where the celestial fireworks are to appear.

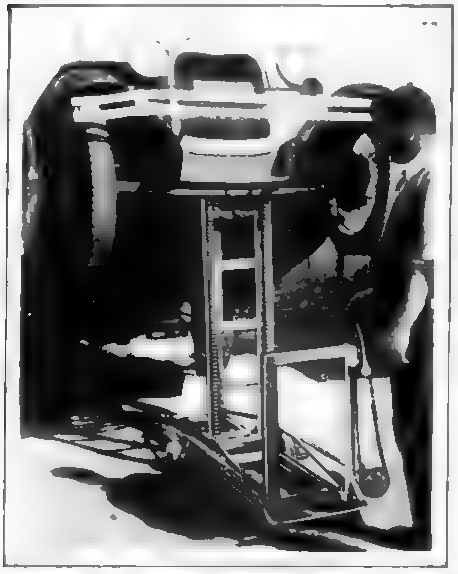
The device is the invention of Thomas C. Poulter, of Iowa Wesleyan College. It saw service with Byrd at the South Pole.



Here's the way to view the Perseid meteors as they hurtle through space. Called a reticle, the wire frame device permits the observer to chart the course of the celestial fireballs.

Car Jack Has Zipper Chains

A RADICAL departure in auto jacks is represented in the invention of a Frontdale, Oregon, mechanic. The elevating mechanism is a pair of chains which interlock on their way up to form an adjustable support to lift any weight as high as three tons. Cars may be raised 5½ feet.



Something new in jacks. Turning crank causes cog wheels to engage two chains which are forced to interlock and form a rising ladder-like support for the car, as shown above.

Science Gets Idea From Tabloids

PHOTO-DIAGRAMS like those made popular by the tabloid newspapers, in which "the cross marks the spot where the body was found" are the newest device to illustrate scientific laws and theories in recently published text books. In one article the ability of a chimney to draw is explained similarly by an actual photograph, with the air currents and their causes explained diagrammatically.

Electricity Prevents Burial Alive

WHAT is claimed as an infallible test of death has been proposed to the French Academy of Medicine. This test consists in applying electric heat to the leg or some other part of the supposedly dead body, using the modern device called a diathermy apparatus. Passage of the diathermy current raises the part of the body to which it is applied several degrees in temperature. If the person is only apparently dead this heat will spread slowly through the body and may be detected after a few minutes by a slight rise of temperature. If temperature does not rise after 30 minutes then burial may proceed. When a test on a body has been made there is no danger that it will be buried alive, as has frequently happened.

Manifold Attachment Saves Gas

IN THE automotive world an invention has made its appearance which promises to effect a great saving in gas. Operating automatically by means of a thermostat the device, shown below, attaches to the manifold, where, when the motor becomes hot, it opens a tiny aperture to suck in air and thus thin the gas mixture. In addition to this, manufacturers claim, there is effected a great increase in power and a quickening of acceleration. Any type of car may be equipped with the device.

Attached to car manifold, this "metal lung" for autos sucks in air to thin gas mixture when the motor becomes hot.

HOUSEWORK *Made Easier*

An attractive addition to the breakfast table is this new electric percolator of all-china construction, cream colored, with tasteful decorations. Capacity is six cups at one brewing.

This handy dispenser now on the market measures exactly the same amount of liquid for each glass. The entire [illegible].

Swiveling on its base so that cord is always straight, this reel prolongs life of wire leads to electric irons and shop equipment. May be attached to any convenient object.

Housewives can scrutinize visitors before admitting them by peering through this new "X-ray," or "one way glass." Installed in door, it looks just like ordinary mirror to anyone on outside, but anyone inside can look through it.

Modern Mechanix and Inventions Editors Will Furnish You With the

With These New INVENTIONS

The hand that rocks the cradle is now a motor. This automatic cradle rocker slides crib backward and forward to soothe the baby to sleep, releasing mother for household work. Rheostat governs speed.

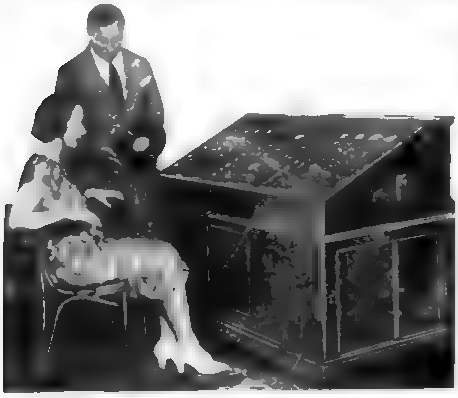
On chilly mornings this electrically heated screen will win your deepest gratitude. Heating elements embedded in the screen material radiate moderate warmth over wide area. Note plug into wall receptacle.

Cleverly built sliding stairway now available for home-builders gives easy access to the attic with no sacrifice of space. Steel weights balance weight of stairway.

New portable washer weighing only six pounds fits over any wash tub to launder the finest laces or heaviest blankets. The heart of the washer is a special agitator built on the vacuum cup principle, setting up a stirring action which cleans clothes in five to six minutes. Rugged construction, with all metal parts of rustproof cast aluminum, assures long life.

Addresses of Manufacturers of Household Aids Shown on These Pages

Machine Reproducing Storm Crashes to Restore Hearing



Records played in this new machine reproduce crash and rumble of thunder in headphones to restore hearing to deaf.

PROCEEDING on the theory that the sound waves produced by thunderstorms supply vibrations to the ear drums which will massage them and restore their normal functions, a New York ear specialist has perfected a machine which promises to give the deaf back their hearing.

Shown in the photo at the left, the machine is similar in many points to an electric phonograph. The records played, however, are reproductions of the crashes and rumblings of thunderstorms, which are transmitted to the patient's ears through a set of head phones.

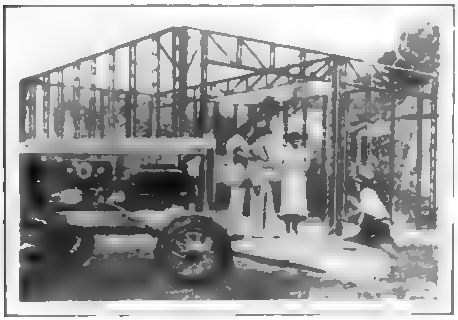
These sound waves exercise the membranes of the ears, and thus rehabilitate the diaphragm which has deteriorated or thickened, causing the deafness.

Arizonans Have Mottled Teeth

AHITHERTO unsuspected health danger from certain kinds of drinking water has been discovered in Arizona, according to the American Medical Association. It is the presence in the water of too much of the rare chemical element fluorine. This causes a condition of the teeth called "mottled enamel" from the blotched appearance developed by the surfaces of the teeth affected.

New Arc-Welded Steel Garage

PROOF against fire, earthquakes and burglars, a new arc-welded steel garage is now making its bid for public favor. Manufacturers claim that the garage, whose skeleton is shown below, embodies new ideas in insulation and ventilation, and at the same time keeps costs of construction unusually low. Framework and walls are assembled with an ordinary arc welding machine, providing as artistic and attractive a finish as the most fastidious could want.



Here is framework of new all-steel garage whose members are arc-welded together. Construction costs are kept low.

Coach Runs on Roads or Rails

WHAT might be termed a land amphibian capable of traveling on road or rail has been developed by railroad engineers to put forth competition to the buses which now ply the highways, cutting heavily into railroad revenues.

For traveling on ordinary roads the coach has the regular pneumatic tire equipment of a bus, but for taking to the rails it is provided with four sets (one for each wheel) of small flanged wheels which engage the rails and keep the car on the track. A special mechanism permits the driver to raise the flanged wheels when he desires to return to the highway.

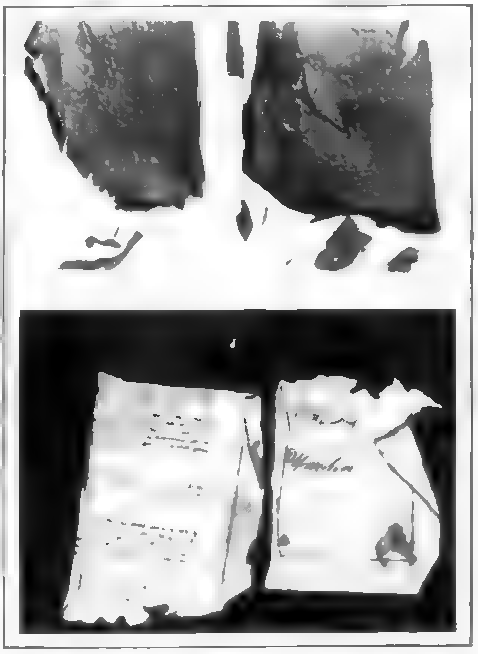
A coach that travels on rails or roads. Set of retractable flanged wheels engage rails and keep car on tracks. Wheels are lifted when the driver wishes to take to the highways.

Graveyards Should Be Cheerful

A CHANGE in public psychology which would do more for human happiness than any other is one in the usual attitude of fear and horror toward death, an eminent scientist recently stated. No small part of this usual attitude is due to the atmosphere of gloom, sorrow and decay in the average cemetery.

Wreaths and similar objects placed on graves by private mourners should be prohibited in favor of permanent flower beds.

Photo Process Reads Burned Documents

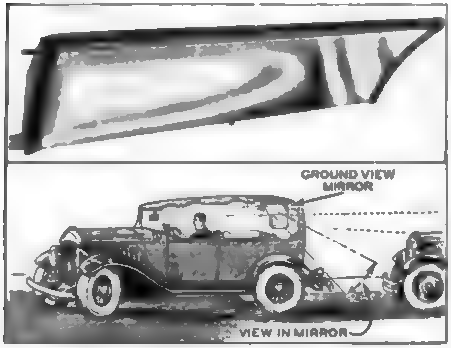


A process for deciphering burned documents is shown above. Ashes of the sheet are placed between specially treated photographic plates and, anywhere from ten to forty days later, reproduce into readable matter. Note the before and after appearance in the photos at the right.

New Rear View Mirror for Cars

TO PREVENT accidents while backing up is the purpose of this new "Rear Ground View Mirror" for motorists. It enables a driver to see the area directly behind his car without the necessity of turning around.

The mirror comes in five different sizes ranging from 24 in. to 32 in. in length. It is screwed into place directly above the rear window.



The above diagram shows area seen in new rear ground view mirror which attaches above rear window.

SENSATIONAL success is claimed for a new process of deciphering the ashes of burned documents, printed and written matter by means of photographic plates. The principle was first discovered in Chicago by a university scientist. However, it has remained for Captain Carl J. Grisbach, in charge of the Pasadena, California, police identification bureau, to advance the idea to the stage where it is practical.

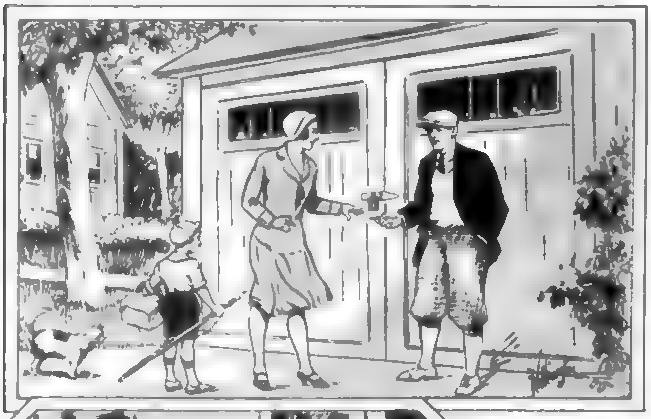
Grisbach takes the charred fragment or the entirely consumed ash, so long as it does not disintegrate, and places it between two dry photographic plates, especially treated.

Anywhere from ten to forty days later, with an average time of twenty days, the original writing transfers itself to the plates and may be photostatically reproduced and enlarged.

The officer's experiments have been conducted over a year's time with 100 per cent success, he declares. He is convinced that it is the oxidation of ink under consuming flame that registers the burned image. Unburned fragments or spots in a charred manuscript show up blank or black. The greater the lapse of time after burning, the more difficult the task of reproduction.

Grisbach believes the new process has far-reaching possibilities in the detection of crime and in the accidental or illegal destruction of valuable papers.

FORTUNE MAKING Ideas



The padlock needs waterproofing. There will be a wide market for a lock which will not become useless after the rain has soaked through it.

Ink manufacturing companies will pay a princely sum for a cork which will eliminate the nuisance of stained fingers and tablecloths.

Fifteen million homes in the United States still are without electric refrigerators. They will welcome an inexpensive refrigeration unit costing less than $30 which can be installed in their old-fashioned ice boxes. New cooling method is needed similar to method of making liquid air.

Simple inventions frequently yield the biggest fortunes, but you have to keep a sharp eye peeled to perceive just what the public needs most. If you fill these needs you'll profit immensely. This month Mr. Yates again sets forth a number of ideas for which, if developed, manufacturers will gladly pay handsome prices.

1. A New Refrigerator Unit

IN PREPARING this material and in the collection of data from recognized sources, I always try to take great care that the ideas I present are practical. I think my readers will agree that it is only on rare occasions that I talk through my hat. I open this month's article in this manner because many of my followers might have occasion to question my suggestion of building a new ice box unit. We have units of many kinds and varieties in a multitude of forms but there is still room for improvement.

What we need is a unit—a very inexpensive unit—that may be slipped into an ordinary ice box and simply plugged into an electric circuit. This unit must occupy about one-fifth the space now taken up by the standard units sold for this purpose.

Another thing: The principle now used for the production of low temperatures through the medium of electric current must be abandoned. It is far from perfect. As a matter of fact, it is crude. If I were going at this problem I should first study the apparatus and principle used in the production of liquid air. Here may be the secret of a new and inexpensive ice machine that will revolutionize the art.

In the development of such a machine, the inventor would open up a market that would appall him with its size. We still have fifteen million homes in America that are not equipped with this new luxury of science and millions would buy a small unit to place in their present ice boxes if that unit sold for about one-third less than

For INVENTORS

by Raymond F. Yates

Instructions to Inventors Wanting Advice

Mr. Yates, who conducts this special department for inventors, stands always ready to give expert advice on patent law and marketing procedure to Modern Mechanix and Inventions readers. When requesting advice, however, do not send models, as they will not be accepted. Your requests will be taken care of promptly and adequately if you merely send a clear drawing and complete constructional and operating data. Stamped return envelope must be enclosed. Address Mr. Yates in care of Modern Mechanix and Inventions, 529 So. 7th St., Minneapolis, Minn.

Millions of homes could put into immediate service a handy little motorized shoe polisher, eliminating the old rag and brush

the units now available.

Specifications: The space occupied must be small and the motor used must be of fractional horsepower. The cost of such a machine should be under thirty dollars.

Exploitation: Should be patented in all of the leading countries of the world.

2. *Waterproof Padlock*

Here is a neat little problem. Padlocks, for reasons of economy and mechanical design, have never been produced that would withstand rain. The water runs down inside the locks and finally the parts inside rust and the lock becomes useless. Indeed, if the lock stands a long time without being used, it becomes practically impossible to open it.

Why should it not be possible to make a lock in such a manner that it will be absolutely unaffected by water no matter how long it remained exposed to the weather.

Specifications: Little or no cost should be added to the expense of making of locks. No complication should be added to the mechanism.

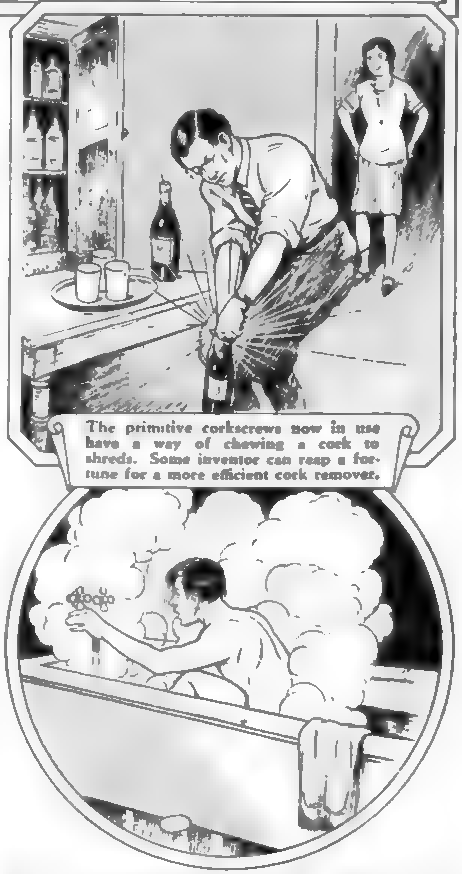
Exploitation: Here is an invention that may be used in all of the civilized countries of the world and therefore should be patented everywhere.

3. *A Top for an Ink Bottle*

Can you, my friend, open an ink bottle without getting ink on your fingers from the wet cork? Assuming that you are clever enough for this, we still have the problem of finding a resting place for the wet ink cork. Many a tablecloth, many a doily, has been ruined with ink stains.

Fortunately, after many years of indifference, the ink manufacturers who are now feeling competition as it has never been

(Continued on page 158)



The primitive corkscrews now in use have a way of chewing a cork to shreds. Some inventor can reap a fortune for a more efficient cork remover.

What a great convenience an automatic temperature regulator would be in the bathroom. Simply adjust a [illegible] to the temperature you want the water, and forget it. The cost of such a device could run as high as $15 and still sell by thousands. Installation must be simple.

Device Plays Music Like Eight-piece Symphony Orchestra

Henry Kublick demonstrating his "Simfonia Orchestrion" which achieves effect of eight-piece orchestra, having a range embracing seven octaves, with tremendous volume.

SINCE electricity has invaded the field of music, all sorts of amazing instruments have appeared. Most outstanding, however, is an instrument which its inventor, Henry Kublick, a world famous musician, dubs a "Simfonia Orchestrion." What has attracted keenest attention to this new device is its ability to achieve the effect of an eight-piece orchestra with utmost fidelity of tone and volume. Its range embraces seven octaves.

Oscillating vacuum tubes are chiefly responsible for the versatility and operation of the instrument. Tone and volume is controlled by a battery of buttons and levers.

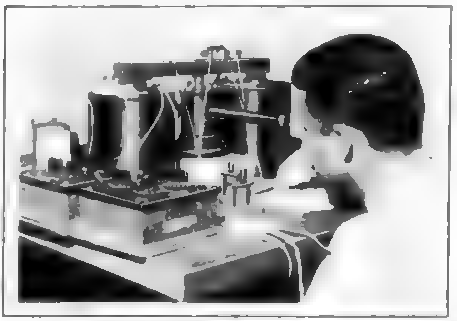
Camera Shows 1 Sec. in 4 Minutes

THE most minute details of a champion high diver's technique may now be recorded for study by aspirants to the crown, thanks to a new slow motion camera recently perfected by C. Francis Jenkins, famous television inventor.

Just to what extent the camera can slow up the speed of a dive is indicated in the claim that it stretches one second of the plunge into four minutes. The camera has a close relation mechanically to the ordinary movie camera, save that the action is far faster. Pictures of the dive are projected on the screen for study by the ordinary camera.

Jenkins camera making movies of champion dive. One second of action is stretched by camera into four minutes.

Delicate Scale Weighs Invisible



Scientist at Cal. Institute of Technology viewing scale of instrument which measures three million-millionths of gram.

EXPERIMENTS being conducted at the California Institute of Technology to determine the approximate date of the creation of the earth have brought forth the world's most accurate weighing machine.

So delicate is this scale that it can measure presence of as little as one one-thousandth of a million-million-millionth of a pound of radium gas, of three million-millionths of a gram of radium. This quantity is about one-billionth as heavy as an invisible bit of down on a humming bird's wing.

The instrument is completely shielded from all external influences and the scale is viewed through a special telescope-shaped tube, as demonstrated in the photo above.

Any Cabbage Butterflies to Sell?

GERMANY wants 200,000 cabbage butterflies and cannot buy them. Even appeals to small boys to catch the insects and deliver them have been futile. As a result an important piece of chemical research in the government laboratories of the German State of Bavaria is held up indefinitely.

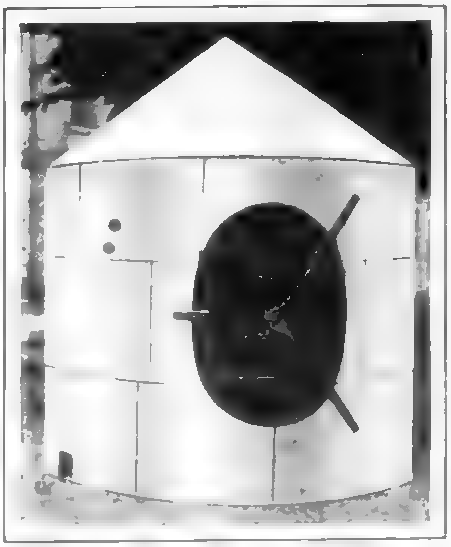
The need of the butterflies, the seekers explain, is to permit chemical study of the pigment materials in their wings, substances about which almost nothing is known. To get enough of the butterfly pigment it is estimated that wings from at least 200,000 of the insects will be necessary.

Back-yard Shelter to Protect Parisians During Air Raids

WARS of the future are expected to take a heavy toll of the civilian population of big cities, but the people of Paris are planning now to protect themselves against bombing raids from enemy planes.

The photo at the right shows a new type of shelter recently introduced in Paris which will shield a whole family from airplane bombs. The shelter is made of reinforced concrete, and, it is claimed, can be constructed within forty-eight hours in any back-yard, garden or field.

A family of six can be accommodated comfortably for several days if necessary. Gas masks and a reserve supply of oxygen are carried as equipment. Tests demonstrated that a direct hit left the shelter intact.



Made of re-inforced concrete, this bomb-proof shelter will protect families of Paris against air raids in future wars. Gas masks and reserve oxygen are carried as extra equipment.

Motorized Display Gets Business

A LARGE motor truck equipped with two full-size display windows is advertising the work done by a Newark, N. J., laundry and dry-cleaning establishment. The display, accompanied by a well-trained crew of contact men, goes through the metropolitan area of Newark and its suburbs distributing souvenirs and advertising pamphlets. The interest aroused creates many new customers for the concern.

Here's how one go-getting laundry in Newark, N. J., gets new customers. The truck, as you see, has two full-size window displays of work done by dry cleaning establishment

You Can Judge Speed Accurately

THE custom of traffic judges to take the word of bystanders about how fast an automobile was moving before an accident often is criticized by experts on the ground that ordinary people cannot judge such speeds correctly.

For once, however, the experts seem to be wrong and ordinary people right. An Evanston Police Court Judge decided to test the claim that bystanders cannot estimate speed correctly. The judge adjourned court to the street outside, had an automobile driven down the street at five different speeds and had five ordinary citizens state their estimates of the speeds.

The results were surprisingly accurate, the average error being less than six per cent.

Something New in Speakeasies

LEAVE it to Chicago to think up something new in speakeasies. The latest novelty in the line of whisperlows to make its appearance in the Windy City is a drinking fountain which gushes water when you whisper kind words into its mechanical ears. The inventor explains that the heart of the magic fountain is a photo electric cell which controls the mechanism. Externally the fountain resembles any other of its public brothers, the mechanism being concealed in the base.

Speak to this Chicago drinking fountain and it will gush a stream of water. Photo electric cell controls mechanism.

PLANE TALK

Edited by DOUGLAS ROLFE

Hectagonal Hangar for Airship Terminals

WITH the day not far in the future when the oceans of the world will be criss-crossed with routes of giant airships, engineers are now setting about the task of designing hangars that can furnish docking facilities to fleets of air liners the size of the *Akron*.

From Germany come the first plans for a hangar, which, though radical in design, promises to remedy many of the difficulties encountered in housing ships of titanic dimensions. Outstanding among the advantages provided is that incoming ships can be run into the hangar in any wind, no matter what the direction and strength. In addition as many as three ships can be accommodated at one time, so that one does not have to be taken out to accommodate one arriving.

Construction of the hangar is illustrated in the artist's drawing below. Hectagonal in shape, the hangar has a door in each side so that ships can be admitted from six directions, depending on the direction of the wind. Since the incoming air liner enters the door facing against the wind, there is little danger that it will be caught by a cross wind and smashed against the structure.

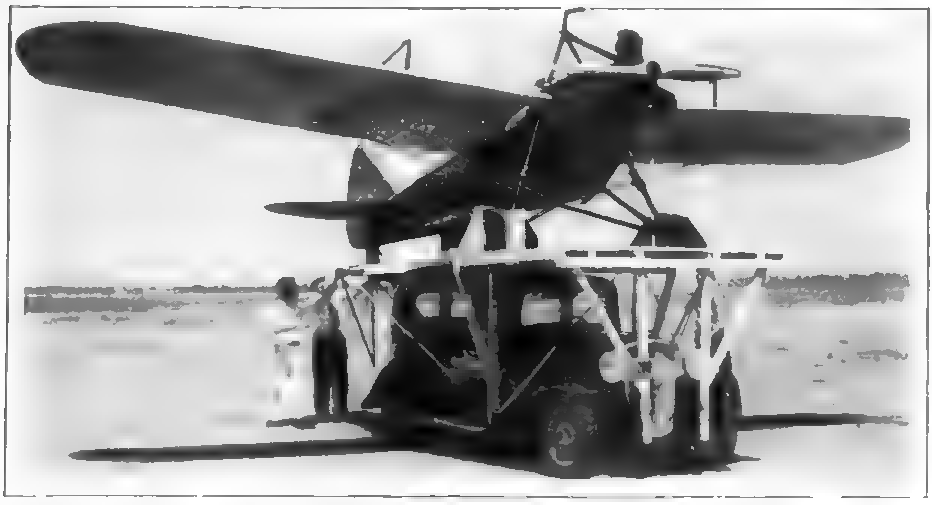
Once in, the ship can turn in any direction for its exit, like a freight train in a roundhouse. The extreme diameter of the hangar, over 1,000 feet, also permits the housing of as high as three Zepps at one time.

In designing the roof, the architect, Dr. Schmalhorst, of Dusseldorf, Germany, took a hint from the plans of the Chicago World's Fair Transportation building. In these plans the entire top is literally hung in the air, being supported by a system of steel cables passing over steel pillars at the sides of the structure.

Dr. Eckner has approved the design.

Giant trans-oceanic air liners of future will find adequate docking facilities in this hectagonal hangar of German design. Ships can enter any time regardless of wind direction and strength, thanks to the six doors, one on each side.

Airplane Launched From Car Platform in Catapult Tests



After 300-foot run at 40 m.p.h., plane was launched from platform on top of car in catapult tests at Los Angeles airport.

WITH a view of determining the feasibility of launching planes direct from a hangar by means of a catapult, Pilot O. C. LaBoutillier, with a group of assistants, introduced a new method for getting a plane into the air.

A car upon which was erected a specially-built platform, did service as a catapult. With the plane resting on this platform, the car worked up to 40 m.p.h., at which speed the plane took to the air.

'Chute Flares for Night Landings

IN PARACHUTE flare experiments conducted recently by the American airways, tri-motored planes were landed at night without the aid of customary field lights.

The parachute flares, which illuminate an area of more than a square mile, are released by the pilot when he learns he will be compelled to land.

Servo Rudder on Big Planes Reduces 90-lb. Rudder Bar Load to 12 lbs.

A SERVO rudder which enables the pilot to reduce the pedal pressure from ninety to twelve pounds on certain plane manœuvers has been installed, as the first utilization in the United States of the servo principle of airplane rudder, on the eight-ton Boeing tri-motored 14-passenger planes operated by United Air Lines on its California-New York route.

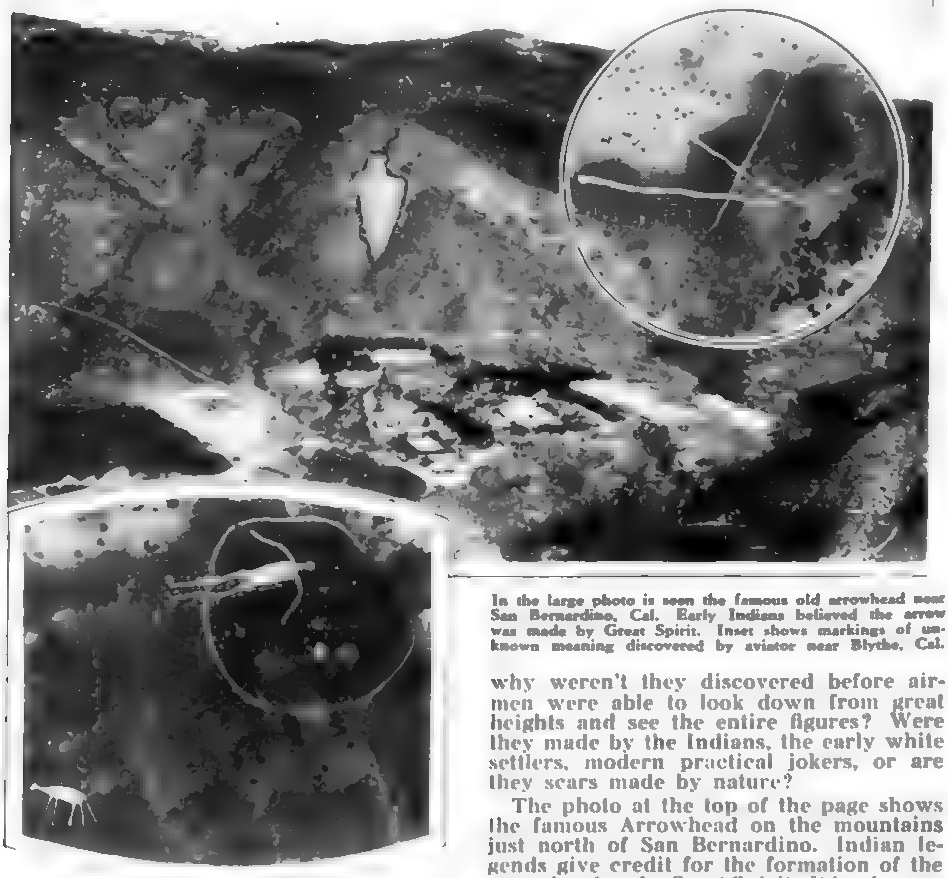
A streamlined metal flap about six inches in width is attached the full height of the twelve-foot rudder, as may be seen in the accompanying photo. A pair of cables attached to the ends of short control horns at the mid-point of the flap run forward to a set of brackets attached rigidly to the fin post.

The normal rudder controls are not disturbed in any way, nor are they attached to the servo control. As the auxiliary rudder is swung it deflects a wind stream which facilitates the turning of the large rudder. The angularity of the flap with respect to the rudder varies, depending upon the degree of displacement of the rudder.

The same principle has been applied to the Boeing twin-engined bombers.

Photo shows Servo rudder hinged to rear of main rudder.

Flyers Discover Strange Earth Markings



In the large photo is seen the famous old arrowhead near San Bernardino, Cal. Early Indians believed the arrow was made by Great Spirit. Inset shows markings of unknown meaning discovered by aviator near Blythe, Cal.

Aerial photo made from altitude of 1500 feet shows mysterious pictographs no one knew existed till an aviator flew over the spot. Scientists can't yet explain origin of figures.

IT SEEMS hardly possible that anyone would walk right over a man 180 feet high and not see him, and yet that is exactly what, not one man, but perhaps hundreds have been doing for many years and never realized it.

A few weeks ago, an aviator flying down the Colorado River saw something, rubbed his eyes and looked again. Although he had flown that same course several times, he had never before seen the figure which now stood out so clear—a man enormous in size, cut out of the soil on the mesa below.

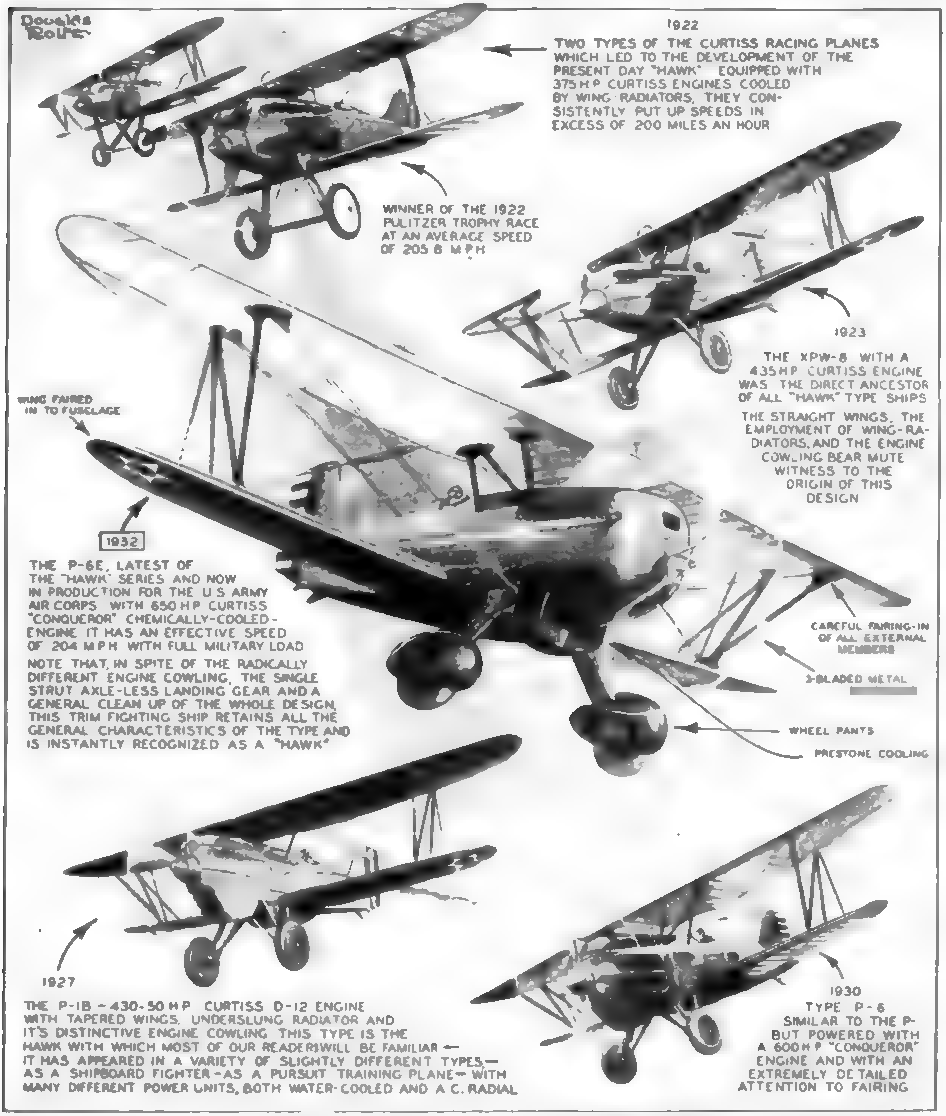
An airplane survey made by the Army Air Corps from March Field soon after the discovery, revealed that there were several of these figures, all gigantic in size and of the same general form. Now just who made these figures, when were they made, and why weren't they discovered before airmen were able to look down from great heights and see the entire figures? Were they made by the Indians, the early white settlers, modern practical jokers, or are they scars made by nature?

The photo at the top of the page shows the famous Arrowhead on the mountains just north of San Bernardino. Indian legends give credit for the formation of the arrowhead to the Great Spirit. It is a known fact that for centuries the Indians have used the arrowhead as a sign post pointing to the hot springs and mud baths as well as for a natural amphitheatre nearby.

The insert in the top photo shows some unusual markings which were discovered by an airman from March Field a very short lime ago. So far no one knows what they represent or who made them. As they are quite near to other markings of the same general type, it is possible that they mark a site where Indian ceremonials were held.

The lower photo shows the first of the man figures discovered north of Blythe, California. Although these pictographs are within 30 miles of that town, their presence was not even suspected until that lone airman flew along and happened to take another look when he saw something unusual. The figure is about 180 feet high. The photo was taken at an altitude of 1,500 feet using a standard aerial camera.

Evolution of a Famous FIGHTING Plane



Here is seen the development of the "Hawk" series from the original Curtiss "Army Pursuit" planes, introduced in 1922.

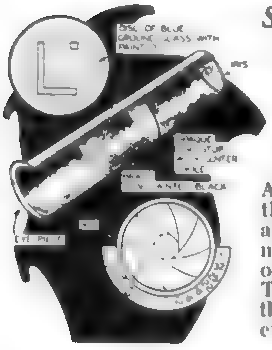
WHEN a squadron of Army Air Corps pursuit planes lands at your local airport it is more than likely that the ships will prove to be Curtiss "Hawks." This deservedly famous pursuit ship, standard for years in the U. S. Army Air Corps, and used by the U. S. Navy and by four foreign countries besides, has been developed over a period of nine years.

Actually it is the result of an even longer period of experiment, for as shown in the above chronological illustration, the "Hawk" series are a practical development of the high speed experiments conducted by the Curtiss Company in 1921 or earlier.

The current "Hawk," now in production for the Army Air Corps, represents the last word in modern pursuit performance. It is to ships of this type that America looks for protection in a quite possible war and the Curtiss Company are to be congratulated on their careful experimental work which has made the production of this superb air-fighter possible.

HANDIKINKS

When you've got some job on hand to perform look through Handikinks department for a method of carrying it out with greatest ease and minimum labor. You'll be surprised to learn how complex tasks can be simplified.



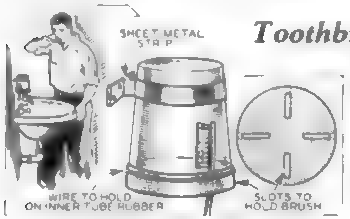
Simple Exposure Meter Helps Make Better Pictures

YOU'LL find this exposure meter of great assistance when it comes to making first-rate photos with high-grade cameras The body of the meter is a brass or heavy cardboard tube five inches in length and painted dull black inside. At one end is fitted an iris from an old camera, at the other a strip of black velvet to form an eyepiece. The tabulations showing stop openings on the iris must be reversed. An inch from the iris place a metal "stop" and an inch from the eyepiece end place the disc holding the blue ground glass as shown in the accompanying drawing. In calibrating the meter, select a bright day, set the iris at f.16 and look at some object. The L painted on the glass should be almost indistinct. The iris pointer should then indicate the correct opening of the lens for a twenty-fifth second exposure. For fiftieth second exposure, use next largest opening of lens. Kenneth Murray.

Grindstone Puts Point on Drawing Pencil

MECHANICAL draftsmen find a small grindstone an ideal instrument for putting a microscopic point on a drawing pencil. An old grindstone is simply mounted on a convenient table, while a rag and a glass of water is also kept handy. When a fine point on a pencil is needed, you simply give the stone a few turns, then bring the point of the pencil against the sides. A turn or two after the sharpening then washes the grit from stone. There is no dust and no refills are required.—Harold M. Haag.

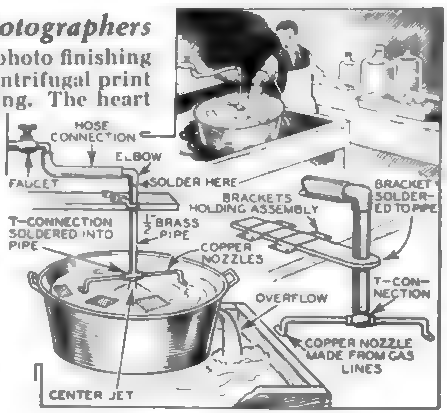
Toothbrush Holder From Tumbler, Tube Rubber



THE average bathroom is badly in need of a germ-proof and dust proof toothbrush holder, and here's just the thing. Over an ordinary tumbler stretch a sheet of rubber cut from an inner tube, in which is made four slits as illustrated at the left. Secure the tumbler to the wall with a strip of sheet metal. When out of use the brushes are jabbed up through the slots, where they are out of germ's way. –Robert Paulson.

Simple Print Washer for Amateur Photographers

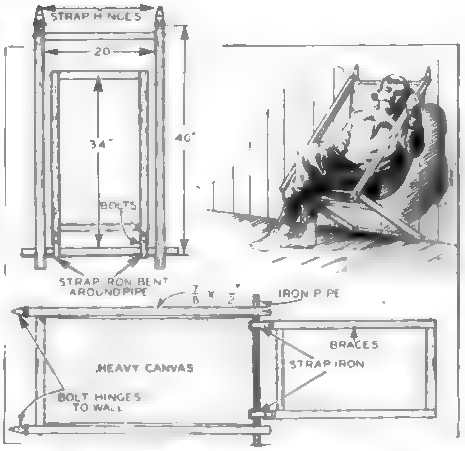
AMATEUR photographers who do their own photo finishing can make good use of the water-powered centrifugal print washer illustrated in the accompanying drawing. The heart of the device is simply a couple of copper nozzles made from auto gasoline lines which are soldered into a T-connection at the bottom of a ½ in. brass pipe. The mass of hypo that will be driven down to the center is broken up by a jet of water issuing from a ¼ in. hole bored in the under side of the T. Note that a hose feeds the water to the washer. The two jets of water from the nozzles keep the prints constantly in motion in the pan. The washer can be set up in your kitchen sink by simply attaching the hose. Note in the accompanying drawing the overflow hole in the side of the pan. —John E. Hogg.

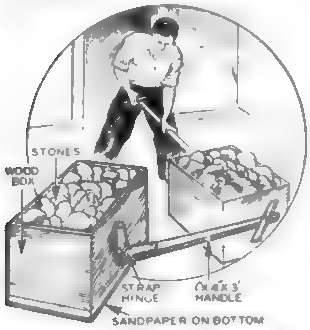


Ideas to Save Time and Effort

Folding Chair for Small Quarters

IN CRAMPED quarters, as for instance in a small cabin boat, this little seat will prove an exceedingly handy piece of equipment. As demonstrated in the accompanying drawing, it literally hangs from a wall, against which it is folded when out of use. The drawing shows how the various elements are assembled. The side pieces are made from ⅞-inch by 1½-inch stock. At the top of the outer pieces are fastened two strap hinges, which are in turn screwed to the wall. Secure the inner frame to the iron pipe with pieces of strap iron, bent U-shaped in a vise. When putting on the canvas, fold over the end of the strip and stitch down, finally slipping the top brace through the opening. Fasten the canvas around the iron pipe after adjusting the length to suit your comfort.—William B. Bennett.



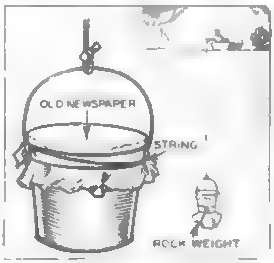


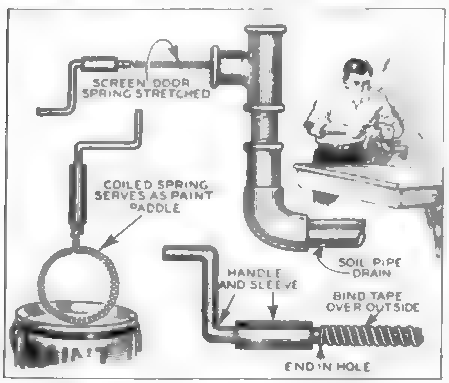
Home-made Floor Sander Does Excellent Job

WHEN you are confronted with the task of sanding down the floors in your home, try this little stunt. Procure a wood box about 12 inches square and fasten a sheet of heavy sandpaper to the bottom. Then supply the box with a hinged handle, as illustrated, and fill with stones to the weight found necessary. Now take this contraption and push it about over the floor in the manner demonstrated in the drawing. After a while you will have a surface as smooth and fine as if a regular sanding machine had been on the job. Use coarse sandpaper first.—A. H. Waychoff.

Pure Water From Lake

IF YOU have a cabin near a large lake, you might find it necessary to procure fresh water from the depths. Here is a way to do the stunt. Take a pail and tie a newspaper around the top with a thread. Then weight the pail and lower it into the water. When it has descended to the point where the water pressure breaks the paper, it will fill up with clear, pure, fresh water, fit for drinking and cooking. The paper prevents surface water from entering the pail when it is being pulled to surface. Sink bucket to at least 15 feet.—Stanwood Bailey.

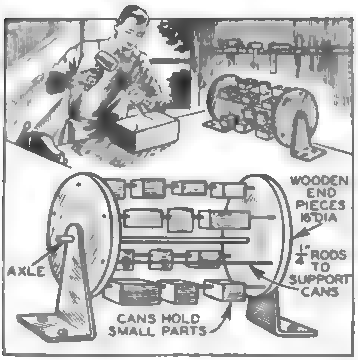




Door Spring Makes Household Tool

AN ORDINARY screen door spring, stretched out until it is six to eight feet long and fitted with a bent rod handle and pipe sleeve makes an excellent tool for clearing obstructed drains. All cloths, paper or soft materials can be wound on the end of the spring and pulled out of the pipe. When used on sinks and basins with small traps, it is advisable to temporarily remove the trap. With the same handle and sleeve, the substitution of a short curled spring provides a paint stirrer. Using this method, even thick and old paint can be stirred and mixed to the consistency of cream. How these stunts are performed is illustrated at the left.—Wesley Watson.

Miscellaneous Handyman Items

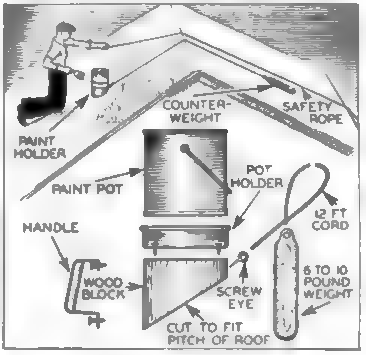


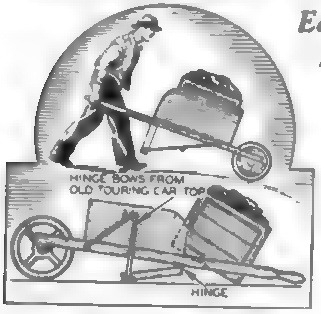
"Ferris Wheel" Container for Small Parts

THE home mechanic is ever confronted with the problem of keeping his small workshop parts in a container where they will always be easily accessible. The handiest container you can build may be made as illustrated at the left. The end discs are approximately 18 in. in diameter, and are supported by means of a pair of uprights. An axle made of a dowel rod runs lengthwise through the center. A row of holes is next bored around the edges of the disc and dowel rods fitted into them, also running the length of the cage. The containers are made from cans of any dimensions you see fit, and are run through with the dowel rods. The whole contraption rotates like a ferris wheel.—A. M. Waychoff.

Making Slant-roof Jobs Safer and Easier

A PIECE of 6 in. log sawed off slantwise, with a cord and a counterweight attached to it as illustrated in the drawing at the right, constitute the principal parts of an ingenious rig made to hold buckets of tar, paint, nails, etc., when doing odd jobs on peaked roofs. Cut the block to accommodate the slant of the roof, and attach a screweye. In addition, you'll find the safety rope a great aid working on particularly sharp roofs.—Walter Wells.



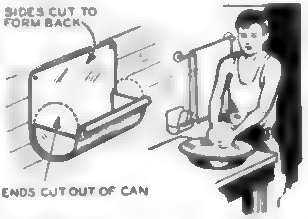


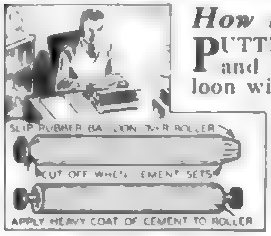
Easy-to-load Barrow Has Fold-up Legs

REDUCING the labor of loading heavy objects onto a wheelbarrow may be easily accomplished by the attachment of hinged legbraces, as illustrated at the left. The legs of the barrow are hinged to the frame and steel hinge-bows taken from a discarded touring car top are employed as the braces. The bows are easily folded to lower the barrow into loading position, and, when the handles are raised again, the legs drop down to support the weight.—G. E. Hendrickson.

Old Tin Can Makes Improvised Soap Holder

WHEN you're in need of an improvised soap container for your workshop, camp cabin, or even kitchen, try this stunt. Simply lay hands on a fairly new and healthy tin can and cut a slit down one side, then remove one-half of the top and bottom, as illustrated in the drawing at the right. Straighten out the back section, and fasten it to the wall at any convenient point. It is advisable to bend over the remaining edge.—Weston Farmer.





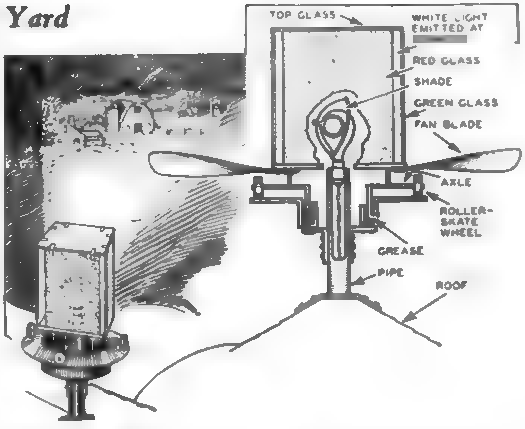
How to Renew Typewriter Roller With Rubber Balloon

PUTTING a new rubber on a typewriter roller costs about $3.00 and three-dollar pieces are scarce these days. An old rubber balloon will do the job just as well. First apply a heavy coat of cement to the rubber on the roller, then cut off one end of the balloon and slip it over the entire roller, tieing one end as illustrated in the drawing. Let the cement set overnight, in the morning cut away all excess rubber, and you'll have new life in your old machine. The lugs will find good padding when they strike the roller, and a clear imprint will be made in typing.—Bob Poolson.

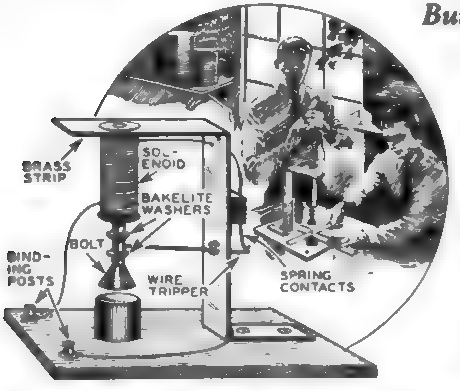
For the Amateur Electrician

Coast Guard Beacon for Back Yard

HOW would you like to have a coast guard beacon right in your back yard? Mounted on top of a high mast or a barn, the beacon flashes red, green and white beams across the landscape. The housing is made of glass set in a wood or metal frame, which rests on a rotating platform. Note how roller skate wheel is affixed to a small axle underneath and how the entire lower part is encased in a metal shield. The lower part of this shield rests in a groove filled with light grease or oil, thus shutting out atmospheric dampness. The light, which rises up in the center, has a shade to direct the rays in one direction. Old fan blades cause the beacon to revolve.—Chet Sullivan.



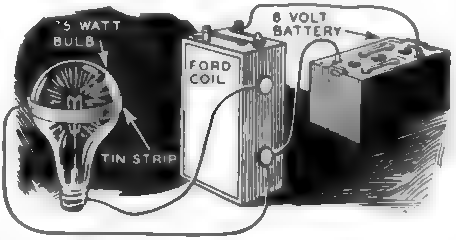
Build a Midget Electric Trip Hammer



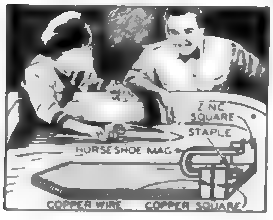
THIS little electric hammer might not be so powerful, but it will teach you the principles on which its big brothers operate. First, wind a small solenoid coil and mount it on the brass bracket shown in the accompanying drawing. Now on the side fasten a bakelite block to take the spring contact, and then attach the tripper, made from a piece of stiff wire. The hammer is simply a flat head bolt on which are fitted two bakelite washers. When the hammer descends for a blow, it causes the wire tripper to strike the contact spring, drawing the hammer up. The contact is broken and the action is repeated. Two or three dry cells will supply sufficient current to the solenoid. -Wilbur Willmar.

Mystifying Glow in Electric Bulb

WANT to mystify your friends with a fascinating electrical display? Then hook up 75 watt bulb, a Ford spark coil and a storage battery as illustrated in the accompanying drawing. Put on your show in a darkened room for the best effect. When the juice is on, the bulb will glow in the most unearthly manner, to the amazement of all beholders.—James Heising.

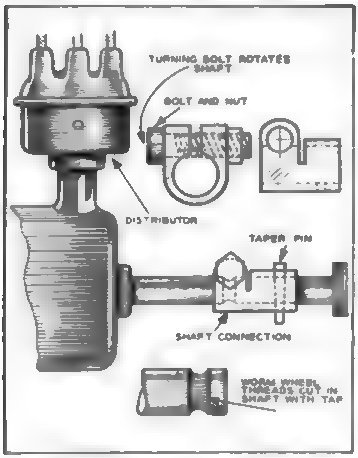


Motorless Electric Boat Sails Through Tub Filled With Brine Solution



TRY this boating stunt in your bath tub, but fill the tub with a strong brine solution first. On a hull a quarter inch thick, an inch wide and four inches long, mount at each side, as illustrated in the drawing at the left, a square of sheet copper and a square of sheet zinc. Next lay the hull bottom up on the table and secure to the former a horseshoe magnet. Then warm the magnet gently and paint it with paraffin. Finally connect the plates with a copper wire. Then when placed in the brine solution the boat will hit off at a surprising speed, due to the setting up of the current in the plates and the action of the magnet.—S. Leonard Bastin.

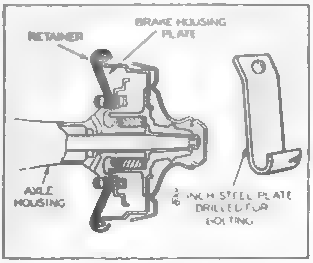
Labor-saving Aids for Motorists



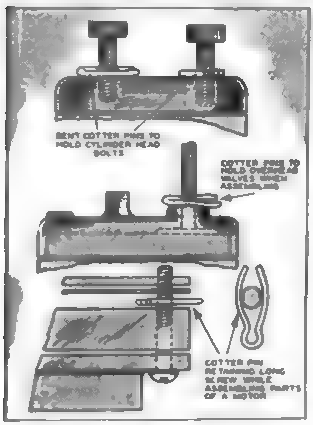
Adjustable Coupling for Car Distributor

A SIMPLE but very serviceable micrometer type of adjustable coupling can be made for correcting the spark timing of the distributor of the car as shown in the accompanying sketch. This method was adopted by one owner, after experiencing difficulty with a plain sleeve, fixed with cotter pins. Whenever adjustment was made to the timing gear chain, distributor removed, chain jumped or after overhaul, the final setting of the ignition was difficult. An ordinary bolt and nut is used to make the adjustment. This bolt engages a worm gear cut into one of the shafts. A coupling is made from steel, one end pinned to the timing shaft through the pump, and the other end, provided with lugs, is split to form a clamp. When the bolt is made tight by the nut, it holds the shaft rigid. The cutting of the worm gear on the shaft was done with an ordinary tap.—G. A. Luers.

Wheel Retainers for Model A Fords

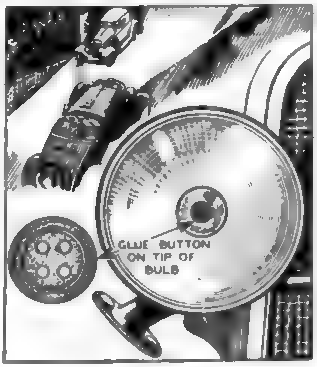


THE rear axles of the Ford Model A car are of the three quarter floating type, and if one of the axle shafts break inside the axle housing the wheel may run off, doing serious damage. To avoid this danger, attach retainers, consisting of pieces of ⅜-inch steel plate. These plates are shaped to conform with the shape of the brake housing plate, and are fastened by the same bolts that secure the brake housing plates to the axle housings. Ends of the plates form hooks, which are set adjacent to the brake drum, clear enough not to touch.—Wilbur Steele.



Cotter Pins Hold Parts Firm on Assembly Jobs

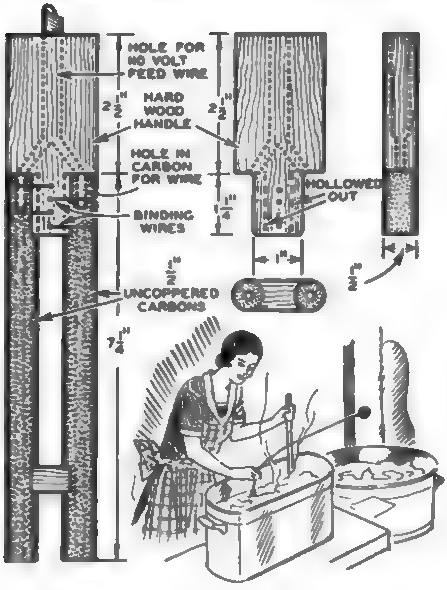
TO RETAIN a float in the engine base while the crankcase is being put up, for holding valves in overhead valve cylinder heads while assembling, to retain bolts in the cylinder head, or to retain bolts and screws in places in the engine and chassis prior to putting on the nuts—for these purposes cotter pins are one of the simplest and best expedients. The sketch shows only three examples of these stunts, which will appeal to the mechanic as a most useful idea for working on small parts. In practice, especially in the assembly of carburetors, generators, vacuum tanks and other small intricate parts, this adaption of the cotter pin as a retainer will be frequently found desirable. The cotter pin can be spread open quite far, and, due to the strength of the steel, will be found tight enough to give a good grip, while at the same time leaving them to be easily disengaged. —Oscar Woolson.



Button on Bulb Softens That Headlight Glare

IF YOU'RE a kind-hearted motorist who is inclined to consider the eyes of fellow drivers, you'll find this light-softening stunt much to your liking. First procure a bone button with four holes, then lay hands on some iron glue. With the latter material secure the former article to the tips of your headlight bulbs. This stunt will take the high glare from the reflectors and eliminate the blinding inflicted upon the oncoming motorist. One precaution—don't use a two-hole button, for it will reflect back an uneven light, and partly defeat your purpose.—Ted Berg.

A Page of Kinks for Housewives



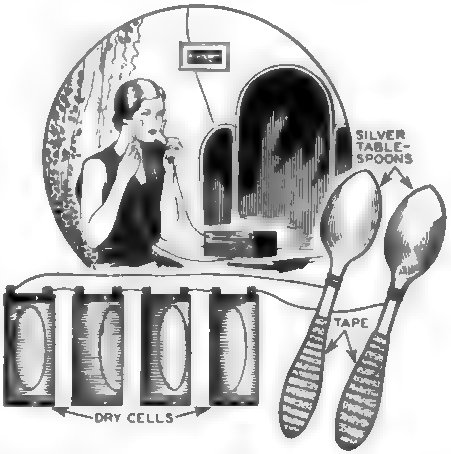
A Carbon Electric Water Heater

ANY housewife will welcome this carbon electric water heater. In addition it will prove exceedingly handy in any laboratory where water has to be boiled. Construction of the device is shown in the accompanying drawing. For the electrodes procure two ½-inch uncoppered carbons and drill a hole in the top of each so that feed wires can be attached. The handle is shaped from two pieces of hard wood, the lower half of which is hollowed out at either side so that the carbons will fit snugly. Drill holes at the points indicated in the drawings.

Carry out the wiring job by first removing sufficient insulation from the feed cord to make a good connection with the carbons. Then run these wires into the holes especially drilled for them, and pour in a quantity of solder heated to melting. This finished, remove all traces of flux, and paint the connection with melted pitch taken from an old battery. The carbons are then bound firmly in place by threading through several strands of copper wire.—Martin Richardson.

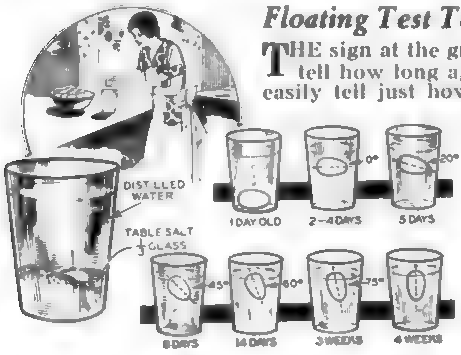
An Electric Massage for Milady

MILADY'S complexion will benefit immensely from an application of "juice" from this little massaging device. There's no danger of shock, and the complexion will not suffer a charring from the current, so it's all quite safe. The only parts needed are: Four or five dry cells, preferably new and fresh; a short length of bell wire, two silver spoons and some tape. The hook-up of all this equipment is shown in the accompanying drawing. Note that the handles of the spoons are insulated with windings of tape, so that all danger of a jolt is eliminated. Apply the spoons to the face as illustrated in the drawing, patting them gently so as to get full benefit from the sparking. If need be, the operator can wear rubber gloves.—Walter Menyhart.



Floating Test Tells Real Age of "Strictly Fresh" Eggs

THE sign at the grocer's might say strictly fresh, but you can't tell how long ago that sign was painted. However, you can easily tell just how long ago the egg was laid by this simple test. Take a glass tumbler or any other glass receptacle and fill it one-third full of common table salt. Then fill it almost to the top with distilled water. Now drop your egg in the water and compare its performance with the drawing at the left. By sighting through a celluloid protractor to get the exact degree of inclination of the floating egg you can tell almost the exact date the egg began its career. Really "strictly" fresh eggs will generally sink gently to the bottom. Ancient eggs will stand on end, large end upward.—Bob Gordon.



Race 'Em All in this

by **Walter X. Brennan**

Here's an ice yacht you'll be proud to sail, for she'll hold her own against all comers in her class. She has the last word in ruggedness and beauty of line, and yet is surprisingly easy to build. Designed by an ice yachting enthusiast of long experience, it has every detail worked out to furnish the utmost in speed and stability.

Here is the Double-M ice yacht in action. Carrying 173 square feet of sail she fits into the established racing class of less than 175 feet. She handles with ease providing you have sharp runners with proper rocker and straight tracking.

AS ICE yachting gains in popularity in every part of the country where there are large expanses of ice accessible, more and more inquiries come in to Double-M as to how a sturdy, "ice-worthy," and economical yacht can be built.

Here is the answer. This little craft is designed to fit into one of the established racing classes at the ice yacht centers. She will give a good account of herself on short spurts or long hauls, and she handles like the best of them. Although many builders will not be interested in the craft's racing capabilities, it is always more satisfactory to have an accepted type, as well as one with resale value.

Lumber Easily, Cheaply Obtained

All of the lumber called for can be secured at an average lumber yard, our first stroke at high costs. Yellow pine is most economical, and of this, enough for the entire boat, can be bought for eight or ten dollars. Fir or white pine will make better material but it will cost a dollar more. The latter should be used, if possible, for the one-inch pieces.

First we will get the runners out. They are cut as shown in Fig. 1, with a bevel to fit the angle iron shoe. It is necessary to turn the angle up but little at the end, but the forward end of the wood should be protected with a piece of strap iron from snow and crust ice.

If the wood isn't of the best, run a couple of bolts down through it vertically, to strengthen it for bad bumps. These should be countersunk under the shoe.

A better runner can be made of oak, in which case 1¼-inch stock will do. The cutting edge must be as sharp as possible without getting a wire edge, or the craft will slide "off the wind" and cannot be steered. There should be some "rocker" to prevent the forward end from "chipping" in rough ice. A long curve, so that the ends of the cutting edge will be ⅛ inch off the floor, is about right.

Bolting Runners to Runner Plank

Now for the runner plank. We will want the heart side down as that will tend to give an arch to the plank in the right direction. Turn it, then, bottom side up. Cut the chuck blocks and clamp them to the runners with their bearing bolts.

Set one of these assemblies in position, square it up and bolt it down. Remember to use washers on both ends of all bolts, else in hard use they will pull through the timbers. Now place the other assembly in

Double-M Ice Yacht

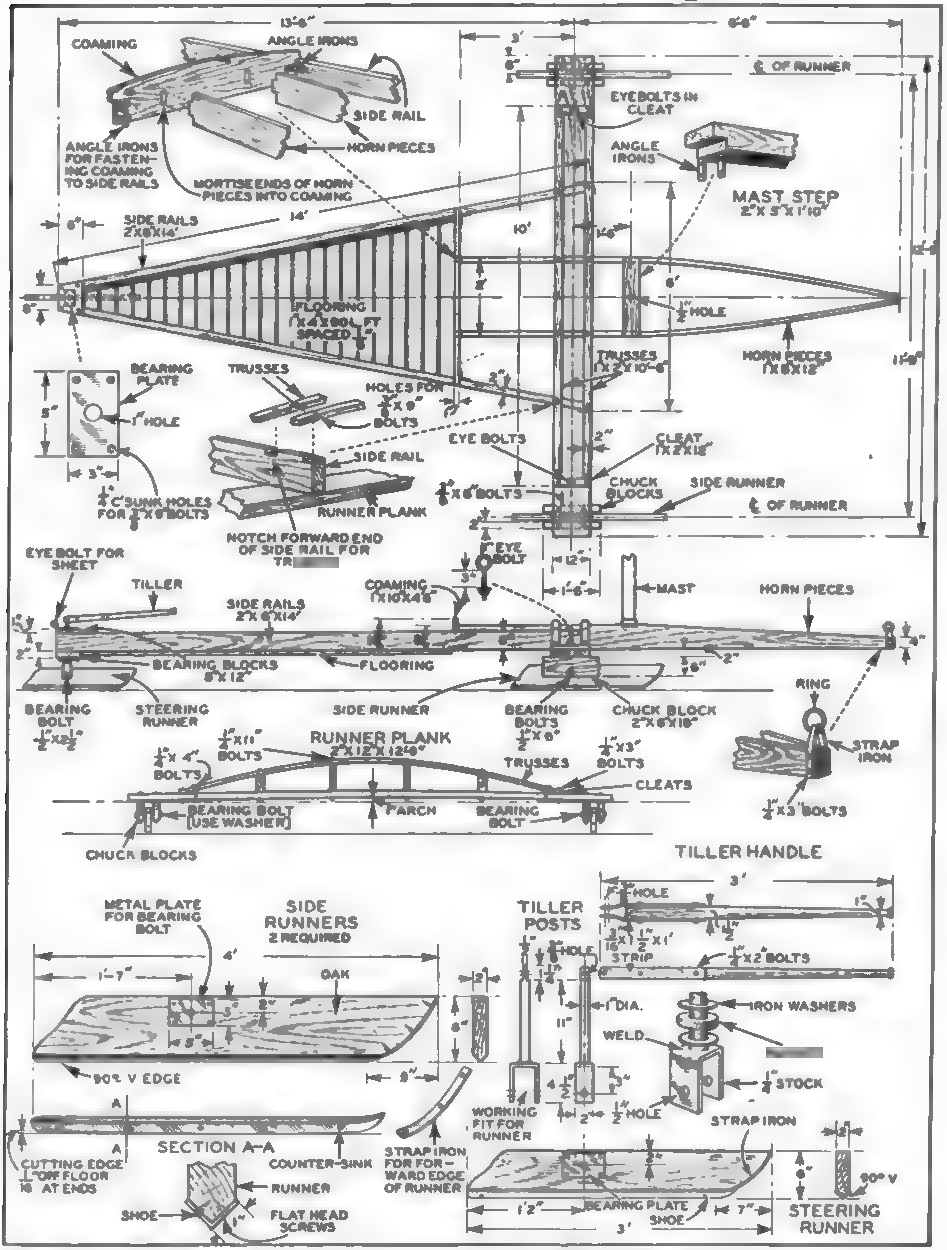


Fig. 1. Dimensions and assembly of hull elements are given in this detailed drawing. Note at top that horn pieces are mortised into the coaming, which is joined to the side rails with angle irons. Angle irons also secure mast step to the horn pieces at point shown, but in case the forward runners slide sideways on the ice, the step, with the sail, should be set further to rear. Three stays which hold the mast in position are fastened on hull to eyebolts at ends of trusses and at top of the horn piece. Runners are given slight rocker, about one-sixteenth inch, to better grip the ice when tacking.

Built-up Construction of Yard and Boom Cuts Cost and Adds Strength

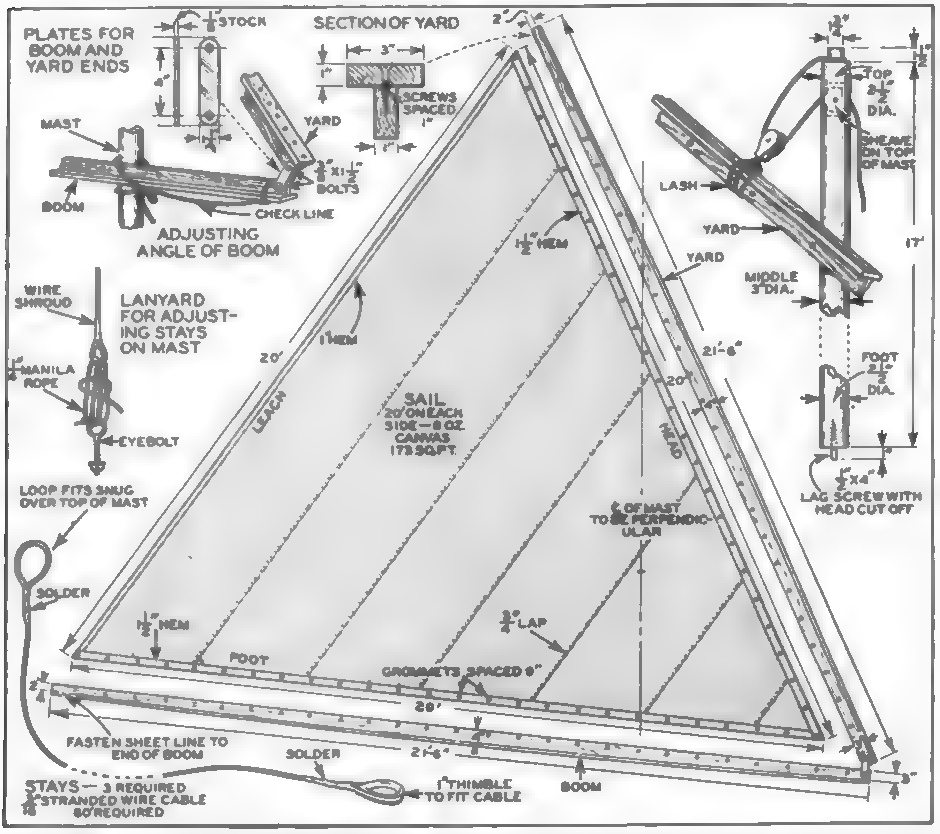


Fig. 2. Built-up construction of yard and boom is found satisfactory in ice-yachting. Splicing will be found necessary in this case. Sail may be set forward or backward by arrangement seen at top left. Note how lanyard takes up slack in the stays.

position, drill one hole through, and bolt.

With a strip of wood or tape, measure across the ends of the runners to make sure the cutting edges are parallel, then drill and place the other three bolts. Also mark the runners right and left.

With the plank right side up, lay on the side rails, mark the ends for proper angles and trim off. Locate and shape the coaming, the horn pieces and trusses. (See Fig. 1.) Better lay down a line on the floor so as to keep things lined up and square.

Fasten the after ends of the side rails with a bolt on each side. Now before drilling and bolting up the parts of the hull, prop up the center of the plank and weight down the ends so the center will be about two inches higher. The two inches will drop to one after it has had a few good jolts and still give a pleasing appearance.

A flat plank always gives the illusion of sagging and suggests poor workmanship. Bolt the horn, side rails and, lastly, draw the ends of the trusses down. Cut the ends square with the plank and bolt. Then put the cleats up snug and bolt. Bolt the forward ends of the horn, fit the mast step and bolt up the stern.

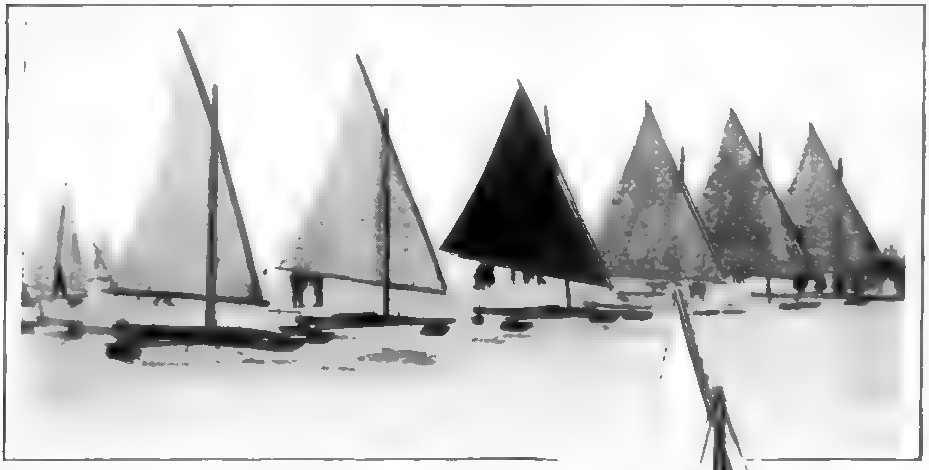
Eyebolts are placed through the cleats or nearby, but on the center line of the plank. Don't get them out too far or they will transmit the jar of the runners to the mast.

Turn the entire craft over and nail on the

BLUEPRINTS FOR THE DOUBLE-M RACING ICE YACHT

Large size shop blueprints, made from the original drawings appearing with this article, are available for $1.00 per set. Many builders prefer to work from these prints because of the ease with which details can be studied, the prints being many times larger than it is possible to present them on a magazine page. Address Blueprint Department, Modern Mechanix and Inventions, 529 South Seventh Street, Minneapolis, Minn.

Variegated Sails of Ice Yacht Fleet Make the Races a Colorful Spectacle



Of all winter thrills, ice yachting ranks first. Here is a group of ships of the class carrying less than 175 feet of sail, lined up for a sprint over the ice. Variegated sails will add glamor to the spectacle of racing with these craft.

flooring. If the boat is square, each succeeding board can be turned over and fitted, leaving no waste. Space the boards a bit so snow and water will not stand in the cockpit. Drill a one-inch hole at the stern and after squaring up the bearing plates with the tiller post in place, fasten the plates in position.

The tiller post and runners are usually the only part that the average amateur builder has not the facilities for making, although some will be able to do the work themselves. The construction is shown in Fig. 1. It is important that a good fit be secured between the post and the bearing plates, as any wabble here will be greatly magnified in sailing and may become extremely dangerous.

Yard and Boom of Built-up Construction

The mast can be worked down from a 4x4 into an 8-sided piece. If the stock is not of the best, increase the diameters given.

Built-up masts are becoming popular, as they are lighter and stronger. One for this boat can be made of two 2x4 pieces. One side of each is gouged out and the two glued together, leaving a hollow mast. Of course this construction must be kept well painted.

For a yard and boom the built-up construction shown in Fig. 2 will serve best. The method is becoming popular in water sailing and is more economical than solid, round spars. Good white pine or, better, spruce should be used.

Such long stock will not be available in most yards, so splices will be necessary. Use one-sided tapers, two feet long. Splices in the two parts should not come together. Careful fits should be made and well glued. The holes for fastening the sail are made to fit the canvas.

Here's the completed ice yacht job, ready to compete with the best of them. Her lateen type sail is manipulated by means of a sheetline fastened to the end of the boom, running down to a block at the stern, up to a block on the boom, then down to cleat in the cockpit.

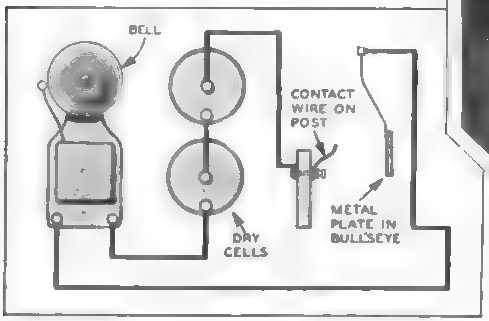
We will use the lateen type sail, which is easy to handle and does fine duty for racing in ice yachts of this size. It is merely an equilateral triangle, 20 feet on a side, and can be made on the home sewing machine. It is best to have a large floor on which the size is chalked for cutting the material.

Leave five inches over on the head and foot sides and an inch on the leach. This will give three thicknesses of material in an

(Continued on page 154)

Bull's-eye Shot Rings Bell

Practice shooting accuracy on ingenious electric target made from odd workshop parts.



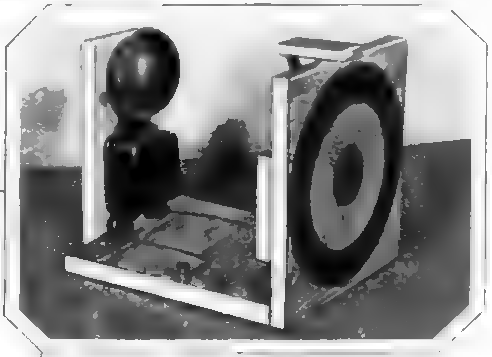


Photo of completed target above will give you clear idea of construction. Batteries attach to binding posts. Fig. 1, at left, gives wiring diagram. Plate strikes wire, ringing bell.

EVERY boy wants to be a good marksman but not every boy realizes that the best aid to rifle practice is a good target, one that will be very visible and one that will register loudly when the center is hit squarely.

All of these benefits will be had with this electric target, since an electric bell rings loudly to indicate a perfect shot.

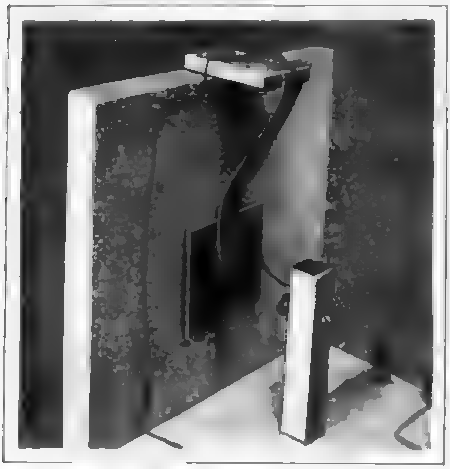


Fig. 2. This photo shows arrangement of parts in rear.

And it's lots of fun to shoot at an electric target—it makes one want to hit the bull's-eye just to hear the noise and then, too, it tells those standing about that the person hitting the mark is a crack marksman.

The bill of materials is quite simple and certainly quite inexpensive. If the builder can succeed in finding an old electric bell about the house the cost of the electric target need not be more than a few cents. If the bell cannot be obtained, one may be bought for twenty-five cents in the 5-25 cents stores.

List of Parts You'll Need

Dry cells small in size but quite large enough for the purpose of ringing this bell may be purchased in the 5 and 10 cent stores. Aside from these items there will be needed a piece of heavy sheet iron about two inches square, a strip of either brass or steel four inches long and three-quarters inch wide. A few pieces of wire and wood, a few wood screws and a little red paint is all that is needed to finish the job.

The baseboard is 6¾ in. long and is provided with a front 6½ in. square. The back member, carrying the electric bell, measures 6 in. long and 4 in. wide. (See Figs. 2 and 3.) These front and back members should be held to the baseboard by means of wood screws. That makes for greater strength, which is needed especially at the front where the bullets from the air gun hit and cause considerable strain.

# of this AIR RIFLE TARGET

The member holding the metal strip which carries the square piece of steel is of wood and measures 2 in. by 1 in. This is cut as shown in Fig. 3 and the bearing is formed by a ten-penny nail. The detail of this bearing will show all of this. The steel plate at the bottom of the metal strip should be about ⅛ in. thick and if such a plate cannot be obtained, the builder may substitute by soldering a few sheet brass squares together, one on top of the other, so that when bullets strike the center they will not dent it. The center of the target is soldered to the end of the metal strip.

If the builder will examine the details of the drawing (Fig. 3) rather closely, he will notice that this center of the target is held to the front board by means of a small metal ketch made out of some sort of spring material. Two small brads hold the ketch to the board, the upper edge being rolled over so that the target center, once it is dislodged by the impact of a bullet, will not stick.

Operating Bell Ringing Mechanism

When struck it should be forced past the ketch and fall against the heavy copper wire held by the upright post shown in Figs. 3 and 4. It is here that the center of the target makes an electric contact which causes the circuit to be completed and the bell to ring. This bit of wire is held to the post by means of a small machine screw.

The hole for the center of the target is bored with a one-inch bit. After this is done, the builder should take a compass and draw the circles shown, one of which

When bullet strikes the bull's-eye, metal plate is dislodged to swing back and strike contact wire. With the circuit thus closed, the bell is set to ringing, indicating perfect shot.

is painted bright red. The metal center of the target is also painted bright red. If the builder wishes he may also paint on a large number of circles.

The circuit is given in Fig. 1. The wiring may be done with bell wire or any small copper wire. Where the wire is loose it may be held down with staples.

In operating the target, the rifleman, once a bull's-eye is made, should not permit the bell to ring too long for this will quickly wear out the battery. Just as the target center is hit, the center should be re-set. It would also be advisable not to shoot at the target at too close range. The range should be about fifty feet and a good marksman should have no trouble finding the heart of the target and the envy of his friends at this range.

If you have lots of shooting fans in the neighborhood you can set up this target and charge for shots at it.

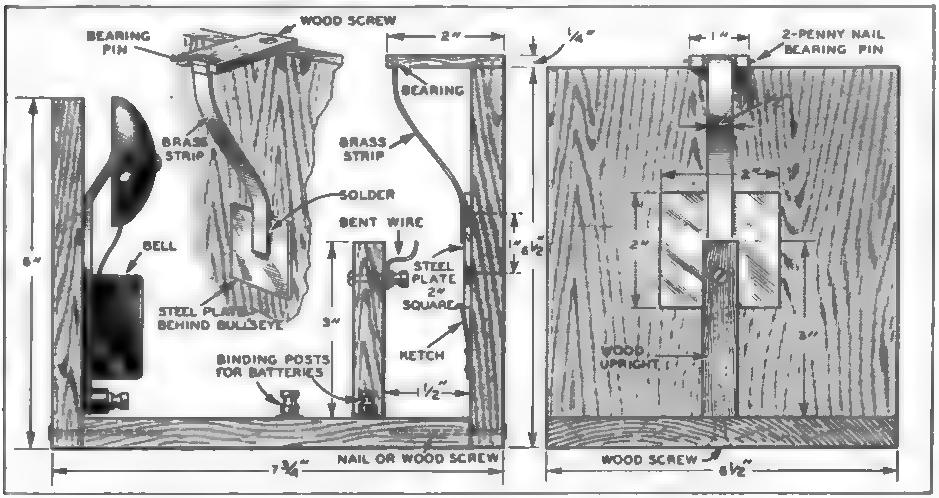
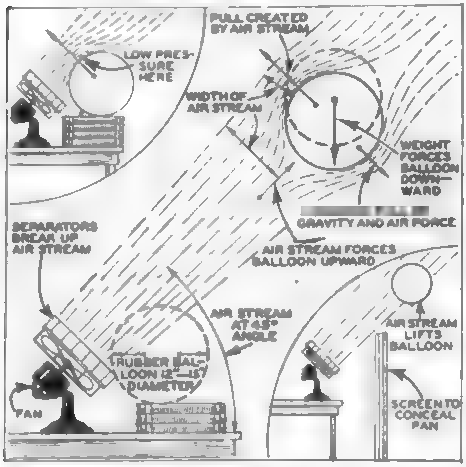


Fig. 3. Dimensions of all details are given here. Note that metal plate is held in back of bull's-eye hole by small ketch.

Two Motors, Run by Sand Power, Built Inside Glass Jars

TWO mouse-power motors, entirely constructed inside the confines of small glass mustard jars and driven by the gravity power of sand, are illustrated above. They are so simple to make, yet illustrate such important natural laws, that the amateur craftsman will derive great fun from them as a table ornament of amusement and instruction.

The motors are mounted to the bases of the screw caps, through which a hole large enough to admit a trickle of sand is punched. One motor, mounted in its frame, is built on the paddle-wheel principle, the falling grains of sand striking vanes and imparting a rotary motion. The other motor consists of a circular disc, mounted on a pin axis inclined at such an angle that the falling sand piles up along one edge until its weight sets the motor whirling merrily as long as the sand falls.



At left, balloon at rest; center, suspended; right, with basket.

Study Air Currents With Balloons

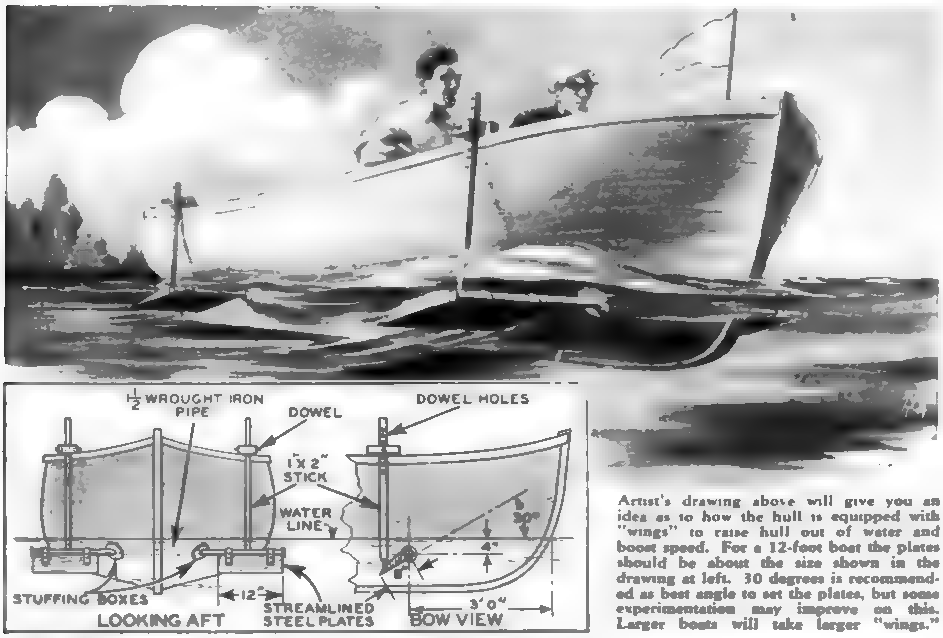
AN ELECTRIC fan and a toy balloon are the only props required to perform a series of tricks that will mystify your friends. The drawing and photographs at the left illustrate the stunts. An "egg crate" grid is fastened over the face of the fan to direct the air in a steady stream. Place a balloon of 12 to 15-inch diameter in front of and slightly below the fan, which is directed upward at a 45-degree angle. Instead of being blown aside, the balloon will be carried into the air stream and held suspended some four feet from the fan!

An interesting variation is to provide a small paper basket for the balloon, whose weight regulates the distance to which it will ascend. If the fan is concealed behind a screen, the mystification will be increased when you toss the balloon into the unseen air stream and nonchalantly tell your audience exactly how it is going to behave.

To prove that no strings are attached, pass a loop of wire around the balloon. Naturally the balloon is inflated with air which gives it very slight negative buoyancy. Hydrogen or other lighter than air gases must not be used. The balloon can be made to fall by interposing your hand in the air stream.

If the fan is turned off gradually while the balloon is suspended in the air stream, it will descend obliquely toward the fan, as the force of air decreases, until it rests again on the table.

"Wings" on Hull Boost Motorboat Speed



Artist's drawing above will give you an idea as to how the hull is equipped with "wings" to raise hull out of water and boost speed. For a 12-foot boat the plates should be about the size shown in the drawing at left. 30 degrees is recommended as best angle to set the plates, but some experimentation may improve on this. Larger boats will take larger "wings."

THE speed of most motorboats can be increased by a simple device that you can make, or have made, at low cost. And the same device also cures boats that have a squatting tendency at the stern when under way. Excessive squatting causes undue disturbance in the wake. It wastes power and cuts down the top speed.

The idea is to raise the hull bodily some six inches to a foot out of the water while under way, the amount of raise depending on the size of the boat and other factors, such as speed. Raising the hull in this way reduces greatly the wetted surface that is rubbing the water and causing friction. The effect is increased speed if the device is correctly installed.

Installation for a 12 ft. Boat

The idea can best be conveyed if the writer describes an experimental job used for testing. A 12-ft. V-bottom rowboat was used, and a piece of pipe was put horizontally through the hull about three feet back of the bow, so that it would be about four inches below the water line with two men in the boat.

Steel plates twelve inches wide beamwise of the boat and eight inches long were arranged to work in rudder-fashion on the pipe and were further arranged to be adjustable with a lever. The swing of the "wings" was such that they could be set level with the water line or tilted to about forty-five degrees with the water line.

A similar pipe, with wings, was put through the hull about two feet, six inches forward of the stern post. An outboard motor completed the experimental plant. The pipes were made watertight where they went through the hull.

With the wings set level with the water line, our best speed over a known course was six miles an hour. With the wings set about thirty degrees with the water line, the speed was a little better than seven and a half miles per hour. This was obtained after considerable experimenting on the proper place to have the pipe at the bow end. If too far forward, the wings tended to keep the bow too far down in the water.

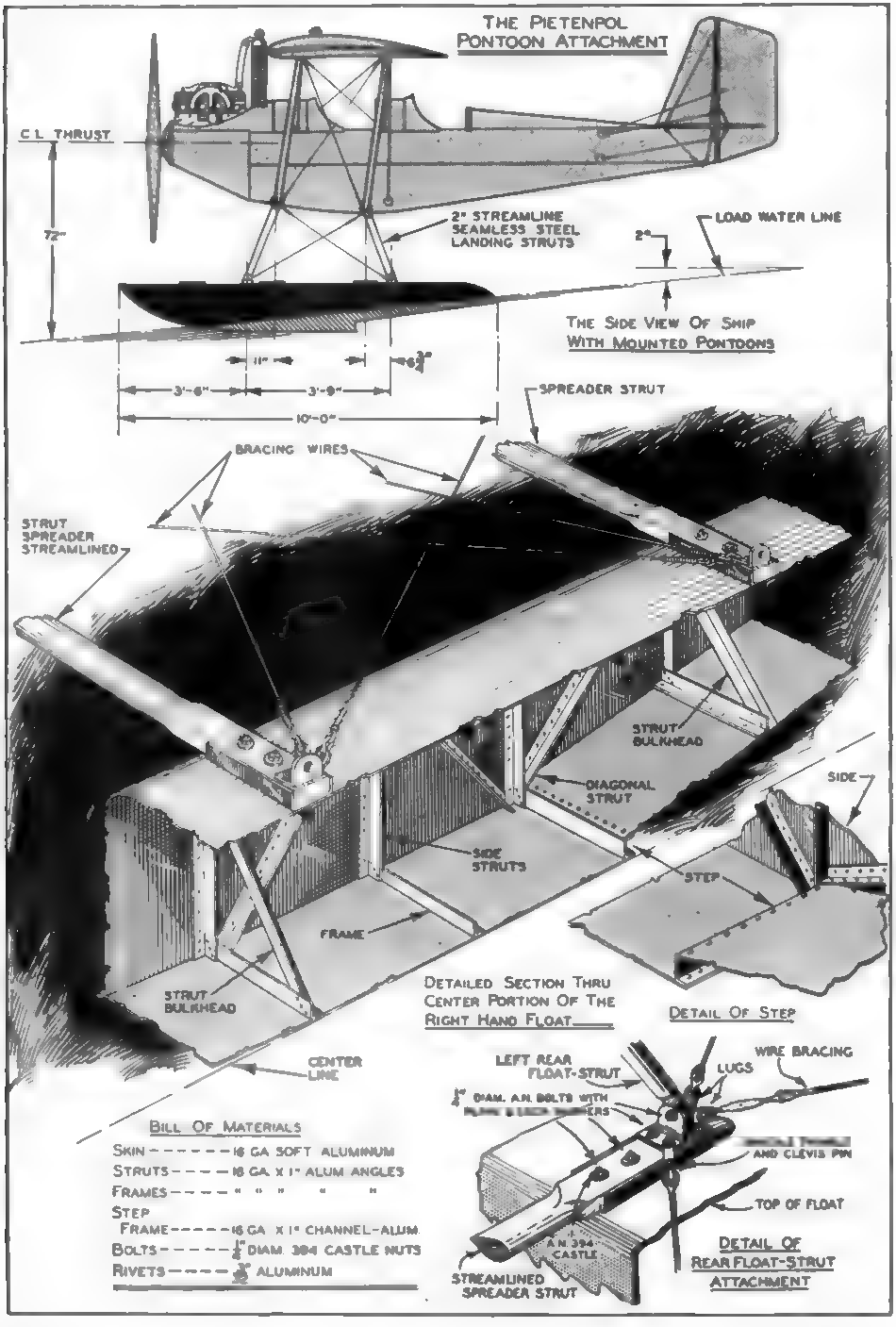
Best Results Require Experimentation

An improvement was also noted when the steel wing plates were replaced with wooden wings, and the surface of the wings was streamlined like the best airplane wings. Strap iron was used to form "U" hinges to go around the pipe and fasten to the wooden wings. The total width over the wings should not exceed the beam.

Later the wing idea was applied to a 28 ft. dory with four wings 24x18 inches, the 24 inch side being beamwise of the boat. A two-inch standard iron pipe was used. The speed was increased from seven to nearly nine miles an hour by the wings.

It was also noted that the wings provide a sort of stabilizing action in rough water; the resistance to capsizing being very great on account of the great purchase into the surrounding water.

This Isometric Sketch Shows Angle Bracing and the Float Placement



Zoomie! Now the lads who own their own ships can delve into off-water activities through the construction of the set of floats described in this article. Here we have a typical Sky Scout adaptation of the floats.

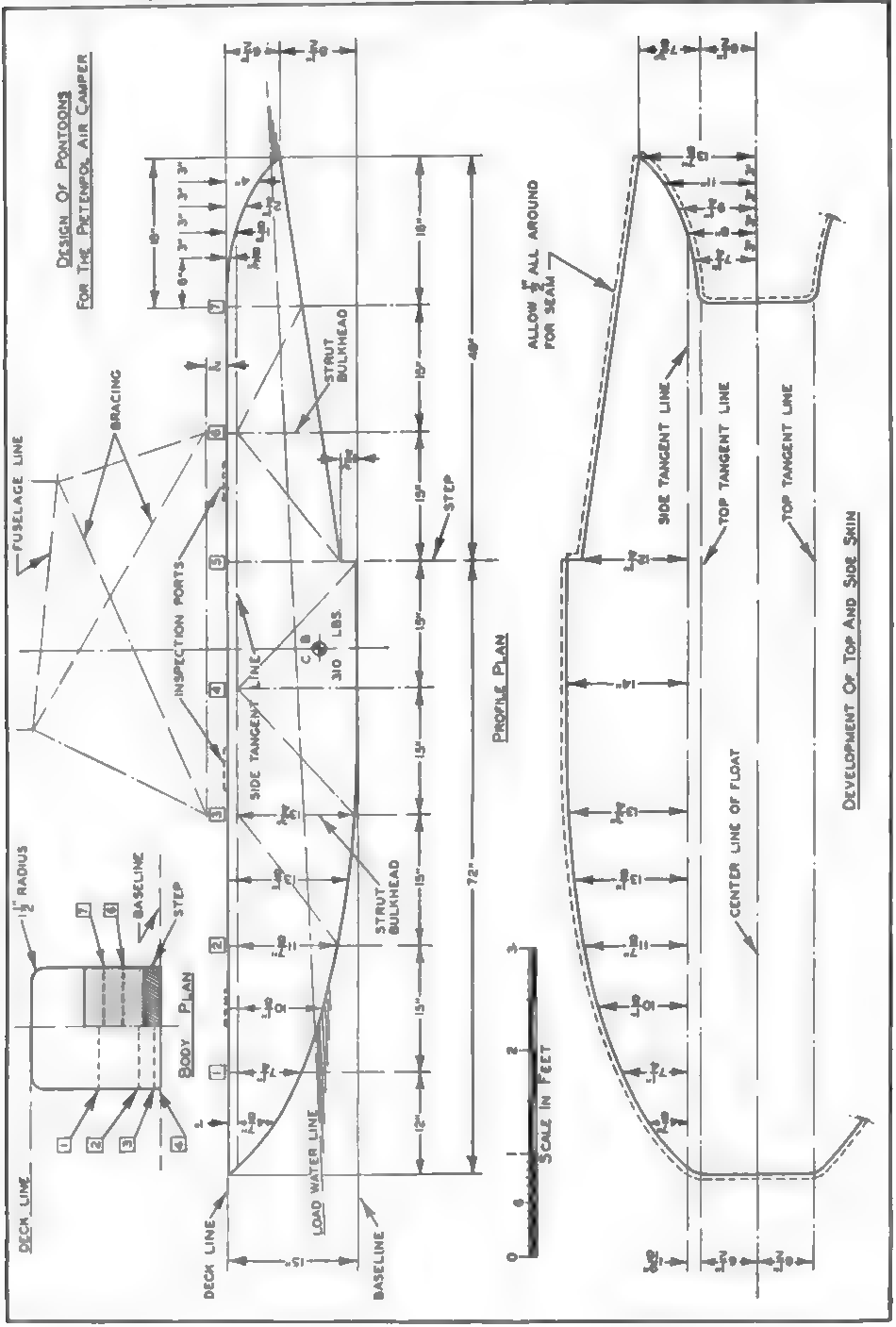
The PIETENPOL *Seaplane* FLOATS, and HOW to BUILD THEM

SO NUMEROUS have been the requests made upon the editors for an article describing the design and construction of a set of floats that we feel sure hundreds of men will welcome this story. It describes a set of light floats which weigh 32 lbs. for the entire set. They are the handiwork of Sam Rabl, who is the factotum at Glenn Martin, in charge of airplane float construction. As our readers know, Sam Rabl is a widely known naval architect, and knows his business thoroughly.

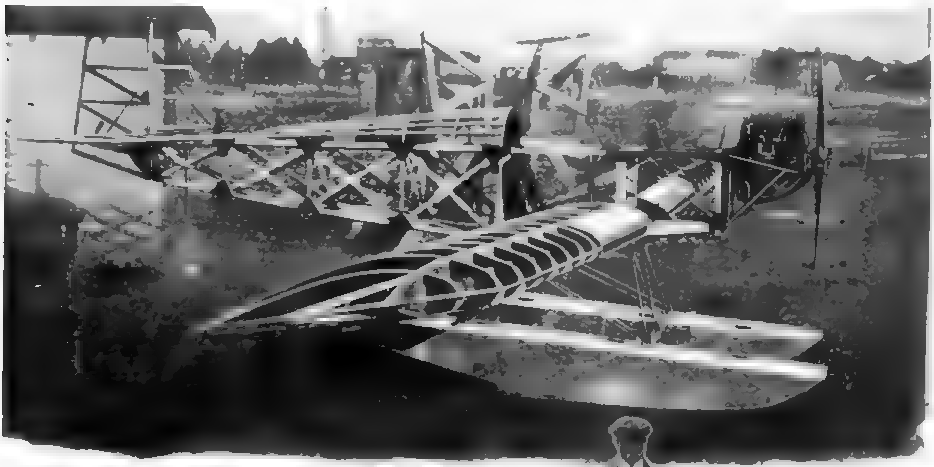
A set of these floats has been constructed according to Rabl's notes and lines, and the results have been integrated here. Along with Rabl's notes we present the observations of Westy Farmer, Orville Hickman who constructed the floats, and the thoughts of all these men have found their way into this impersonal writing.

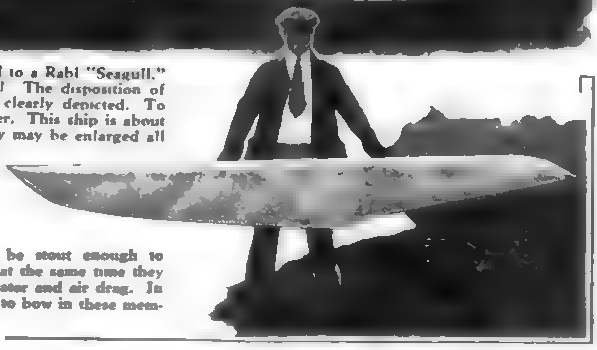
To begin with the choice of type. Usually designers of big powered stuff like to stick to the single-float idea as it is aero dynamically much more efficient, and ships will handle better in spins. However, single-float ships are hard to beach, difficult to taxi, and require a lot of water-sense in the pilot that takes as much time to acquire as air sense. A single-float job is neither fish nor fowl until it gets into the air. The two-float remains the most

Floats Designed for Ships up to Six Hundred Pounds Flying Weight



Simplicity of Seaplane Floats Makes Easy Building; Weigh 16 Lbs. Each





Above is a photo of the Rabl floats adapted to a Rabl "Seagull," a low wing seaplane designed by Sam Rabl. The disposition of the floats in relation to step and ship are clearly depicted. To the left: Floats as adapted to an Air Camper. This ship is about the limit in weight for these floats, but they may be enlarged all around by 20% to take ships weighing up to 1500 lbs. The framing is shown in cutaway, exposing the home-made angles to view. Right: Orv Hickman, Robbinsdale, Minn., airplane maestro, shows how one of the 16-lb. floats looks in his hands. It is highly important that the cross members be stout enough to separate the float without bending, and yet at the same time they must be streamlined so as to reduce both water and air drag. In the photo above there was a slight tendency to bow in these members, which was later cured by 1¾ in. by 3 in. spruce struts.

popular idea for practical reasons. It requires no wing tip floats and thus can be used with the Parasol type monoplane. Each individual float is stronger by reason of being smaller. The bracing is better and will take a lot of abuse. Both hydro dynamically and aero dynamically the two-float system is a little inferior to the single-float, but practicality demands that the system be used for the small ship.

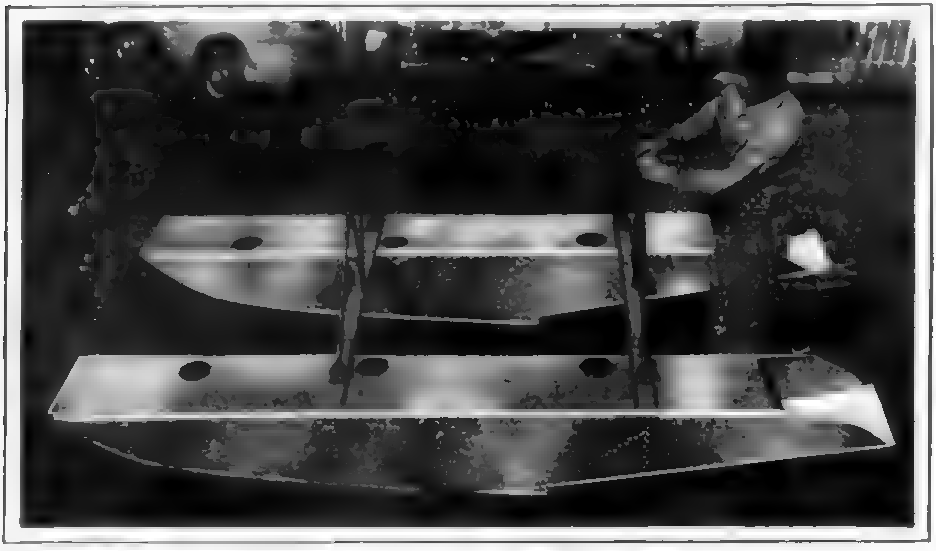
Aero dynamically the two-float offers more drag. Hydro dynamically the long thin floats placed side by side catamaran fashion have a lot of interference with each other's wave systems which is missing in the single-float type. To be properly efficient planing surfaces must be wide for water. But when they are too wide you will get frog jumping and terrible landing characteristics.

There seems to be a mistaken notion that a ship fuselage with a seaplane float system underneath, sans wings, will give a lot of speed. Not so. The same power in a boat of twice the weight will give about the same efficiency. You see wings lift a ship as the speed increases, and the load becomes then very light on the floats. We have seen some of these wingless contraptions, but they were slow, wet and worthless.

So as we have figured it, we have a good set here for the ship which does not weigh over 600 lbs. ready for flight. Oh, a hundred pounds either way will not matter a great deal, as far as the floats go, but if you have a heavier ship better increase the length and beam measurements about 20%. This will enable you to carry loads in excess of 1,000 lbs. The loaded weight the floats on the Rabl Seagull supported was around 600 lbs. The usual rule is to allow 100% excess buoyancy.

Now for the architectural considerations. Every ham naval architect knows that straight lines make for easy speed on the water. The flatter the bottom, the straighter the sides, the more "water efficiency" you have. Floats that are pinched in at the stern are demons to control on take-offs and landings. Edo floats are steeply v-d in cross section for the center half of their beam, and then switch abruptly to flat at the chines or sides. This makes for smooth landings in choppy water, for as the ship comes in the sharp vee kills shock, and as the speed decreases the flat portion takes up the load and al-

Structural Design of Floats Shown to Good Advantage in This Photograph



Here the floats have been sparred and braced with a double Vee undercarriage to show how the cross struts fit into the channels. Note that the sides and bottoms are completely riveted. The ends have been left open so the interior may be coated with C quality Jeffries marine glue, particularly at the seams. The curved end pieces are riveted on last thing. Hand holes for bailing are covered with rubber washers especially made for floats by Goodrich.

lows the ship to plane along and settle after the wings have quit carrying their load. But this type of construction is too complicated for home builders. There is a set of floats by Rabl as described in the 1929 FLYING MANUAL which has this type of construction for those who wish to look it up. Can be obtained from the offices of MODERN MECHANIX AND INVENTIONS, 529 So. 7th St., for 50c the copy.

The floats shown here are much simpler. They are built of either 16-gauge soft aluminum which will dent easily, or 24-gauge dural, which is tough, and weighs about the same. The frames are of 16-gauge soft aluminum, and the rivets are better made of ⅛" aluminum spaced about ½" than the 3/32" rivets described on the drawings. These drawings were made as the float progressed, and we feel that ⅛" is a better rivet. See the 1930 and the 1931 FLYING MANUALS for methods of riveting these pieces of aluminum together.

The first thing to do is to lay out the float full size, and then take the piece of brown building paper on which you do this, and mark out the pattern of the top skin as shown on page 112. If the supply houses such as the Corben Sport Airplane Co., of Madison, Wis., cannot supply you with sheets large enough, the sheet may be made up by riveting two sheets together along the center line. We did this with our floats.

Be sure and allow enough extra as per the dotted line for the riveting lip.

Then the float jackets are bent to rectangular cross section with 1½" radius at the tangent lines.

Then angle frames are riveted in as shown by the dotted lines on the lines drawing. The rivets at the frames will have to be 3/32" staggered and about an inch apart. The best way to do is to rivet the pieces at the ends, and then drill with an oversize (slightly) drill and rivet as you go. The angle frames can be made from flat pieces bent to right angles on a tinsmith's brake and trued on an anvil if need be. Avoid hammering as much as possible, both in the float and on the individual pieces, as you will find you will get a better float. Just avoid hammering the thing all over the place. But don't be afraid to set each rivet down tight and do what hammering you have to.

When the angles are inside the float the riveting lip is net 45 degrees all around, and the bottom is put on. Start with the front step at the box, and rivet across the snoot of her. Then work a rivet at a time

(Continued on page 151)

BLUEPRINTS FOR LIGHT PLANE FLOATS

Shop blueprints made from the draftsman's original drawings accompanying this article are available from Modern Mechanix and Inventions Blueprint Department, 529 S. Seventh St., Minneapolis, Minn., at $1.00 per set, postpaid in U. S. and Canada. The drawings are many times larger than it is possible to reproduce them in a magazine page, and builders will find that they simplify the process of construction.

Things to Make with Tools

Edited by A. NEELY HALL

A Demountable Collegiate BOOK Shelf

COLLEGE boys—and girls, too—have a dire need of convenient, space-saving furnishings in their crowded dormitory rooms. To meet this need an engineering student designed the demountable shelf shown in the illustration, which shows one of its possible uses.

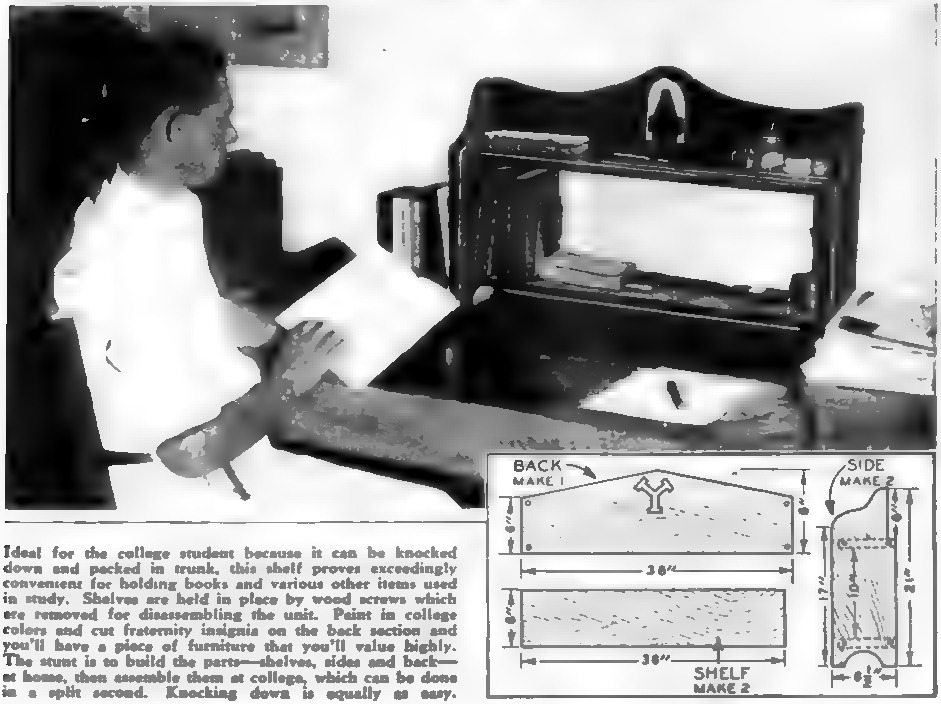
Any college boy can make this article in the home workshop during Christmas vacation. When the winter session begins he has only to loosen a few screws, lay the separate pieces in the bottom of his trunk for shipment, and in four minutes, after reaching his room, he can assemble the shelf and have it conveniently placed on his study desk or table. Then, every day of his college career, he will be glad of the few hours spent in the workshop making it.

Plans for making the shelf are shown clearly in the drawing below. Simply cut the pieces to the dimensions given and screw them together. Any kind of wood may be used, but oak, walnut, gum, poplar, beech and other hardwoods prove most satisfactory.

Materials needed are: 1"x6" board, 6 ft. long; 1"x8" board, 38 inches long; 1"x7" board, 42 inches long (this piece may be used full width or planed down to 6½" as shown in illustration and design); 12 2" round-head screws; and paint, enamel, or stain and varnish, according to choice.

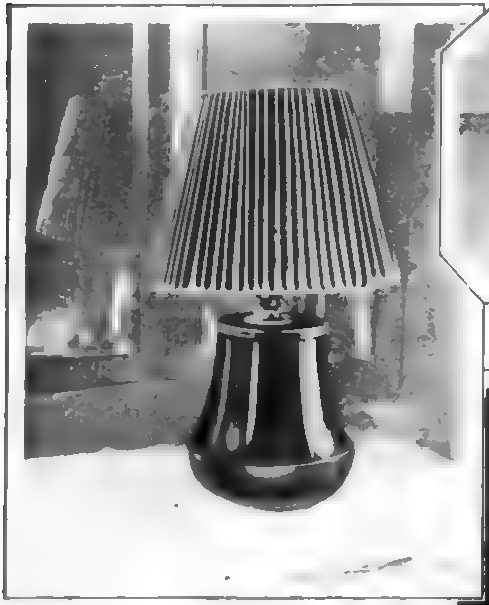
Tools required for construction include a hand saw, compass saw, plane, screwdriver, coping saw, ruler and sandpaper.

In making the shelf the student may be as plain or as elaborate as he wishes. With the compass saw he may describe any curve he desires in sawing out the two upright pieces and the top. With the same tool he may also turn the letter or emblem representing his school or fraternity. Painted in his college colors he will certainly value the shelf and may endear it through life.

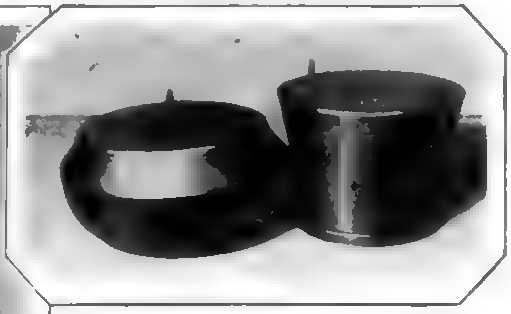


Ideal for the college student because it can be knocked down and packed in trunk, this shelf proves exceedingly convenient for holding books and various other items used in study. Shelves are held in place by wood screws which are removed for disassembling the unit. Paint in college colors and cut fraternity insignia on the back section and you'll have a piece of furniture that you'll value highly. The stunt is to build the parts—shelves, sides and back—at home, then assemble them at college, which can be done in a split second. Knocking down is equally as easy.

Artistic TABLE LAMP has

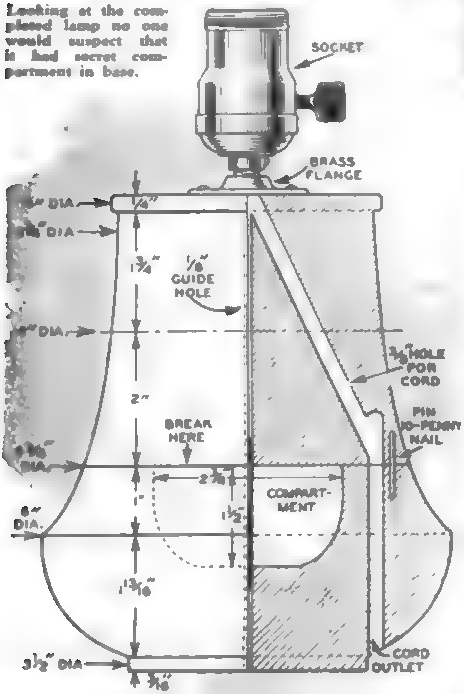


Looking at the completed lamp no one would suspect that it had secret compartment in base.



Here is seen how the spikes are driven into the base sections. One is in dead center, other should be at side.

Secret compartment is turned out on the face plate. Note holes for pivot pin (10-penny nail) and lamp cord on side.



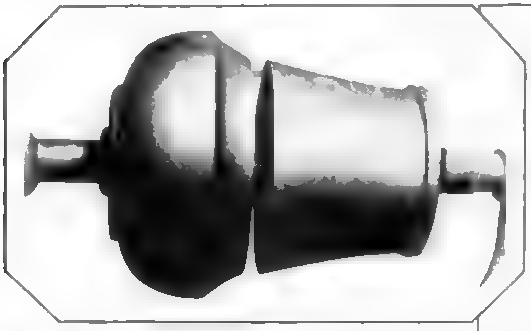
Turn down base and bore cord outlets as drawing shows.

THIS lamp project will appeal to the home shop fan primarily because it is easily made, and because of the intriguing hidden tray or recess within the turned base. Closed, the lamp looks innocent enough and defies a rather close inspection without making its secret known. Yet when you know how to operate it, you open up the compartment with a single quick movement.

Two blocks of walnut 6½ inches square and 1½ inches thick were glued together, using the centers of the lathe with sanding disc and face plate to hold them square. Let the glue dry for 24 hours. These blocks form the lower portion of the lamp. The upper portion consists of two more blocks each 2 inches thick and 5½ inches in diameter, glued up in the lathe in the same manner. Both sets of blocks can be glued at the same time if desired.

When the glue has dried, a small hole is bored through the center of each block and a nail with the head removed, to form a tight fit, fitted into the bottom hole of the upper portion and the top hole of the bottom portion, then both portions set in the lathe and turned down. The accompanying

Secret Compartment in Base



Nails shown here serve to hold the top and bottom sections together when lathe turning job is being performed.

sketch shows the important dimensions, which may be followed loosely if desired. After turning down to shape, the outside was sanded well to remove all tool marks, then finished with No. 00 sandpaper and the surface filled with filler mixed with walnut stain. Later the surplus filler was wiped off, and after 8 hours the piece was speeded in the lathe and rubbed with a rag to give a nice luster.

Here the two pieces were removed and separated and the exact spot for the pivot pin—made from a 10 penny nail—marked and holes bored 1 inch deep. Each hole should be exactly ⅝ of an inch from the outside edge of the lamp. Close to this, between the center of the base and the hole, a ⅜ inch hole was bored to and through the bottom of the base for the cord outlet, as shown in an accompanying drawing.

Finally remove the top portion of the lamp and turn the recess in the top of the bottom piece 2¾ inches in diameter and 1½ inches deep. By cutting a longer wire pin to fit you can again reassemble the two parts, put back in the lathe and again polish and finish to your own taste.

Top section of the base swings around on the pivot pin, disclosing a secret compartment, which may be used to conceal valuables. Note how socket is mounted on top.

The center pin is now removed and the lamp wired as illustrated in accompanying drawings. Run the cord through the hole in the lamp bottom and to the end connect an ordinary plug. A thin sheet of felt should be glued to the bottom to prevent a possible marring of a table top.

Holding the base with one hand, you can turn the upper portion around to the right or left to disclose the inner recess. The top will turn nearly 90 degrees to the right or left and by making a slightly larger hole for the cord this arc will be increased.

This project has substantial, chic lines and, because of its novelty, is exceptionally good for gift and holiday purposes.

Grow Miniature Garden in Greenhouse Made From Old Negative Plates

AN INTRIGUING form of the miniature gardens that are now so popular can be enclosed like a greenhouse by the use of discarded negative glasses of the 5x7 in. size. Five glasses are needed, two of which are cut down to 5"x4⅞" for the ends. These glasses are fitted together so that the top glass rests on the four side walls, the ends coming flush between the long sides. Fix the glasses together by applying narrow strips of insulating tape on the outside.

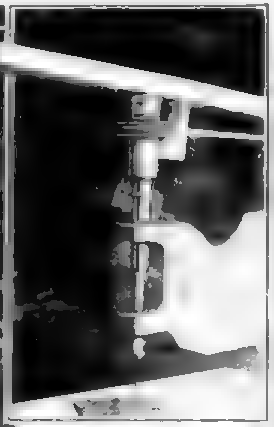
For the base which holds the soil, use a "fifty" cigar box. It may have to be cut down to fit the glass top. Run a narrow moulding around the inside to support the glass. Rubber cement the joints of the box and apply tape. Line the inside of the base with tinfoil and finish the outside with one of the patent wall-plasters, put on in a rough texture. Color the tape a moss green.

To make the garden put half an inch of coarse sand or gravel on the bottom of the box, then fill with good soil finely sifted. Plant flowers according to your taste.

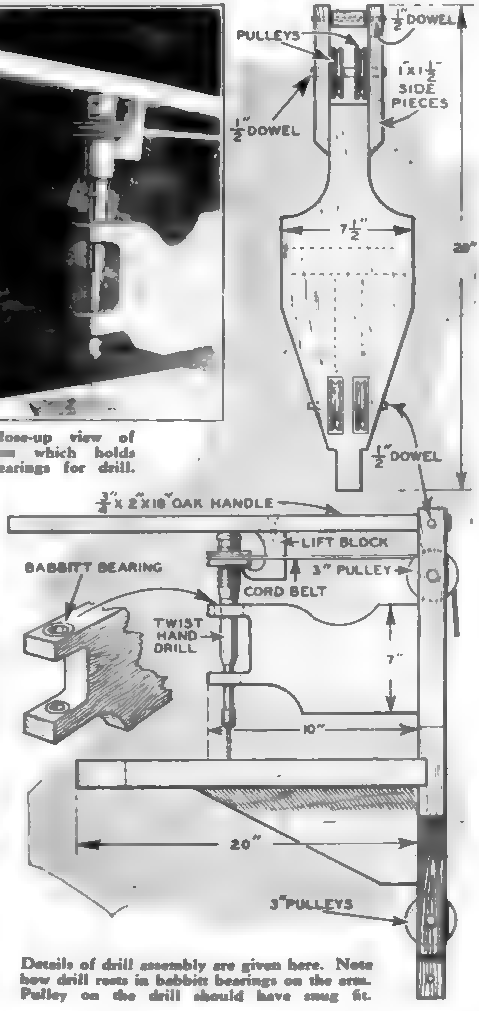
Last word in ornamentation is this midget greenhouse. Top is photo plates, base is cigar box. Cover soil with moss.

Hand Drill Does Duty as Power Drill

In the operation of the power drill, pressure is applied against the oak handle, which in turn bears down on the drill. Lift block under pulley raises the drill point.



Close-up view of [illegible] which holds bearings for drill.



Details of drill assembly are given here. Note how drill rests in babbitt bearings on the arm. Pulley on the drill should have snug fit.

A HOME shop craftsman, needing a power drill in a hurry, and having only a hand twist drill, made and assembled this simple, rugged unit which has worked well ever since.

The frame consists of a table, an arm and an upright, all of wood. The hand drill fits into babbitted holes and has a wooden pulley forced onto the ferruled handle. Pressure is applied by an oak arm which presses against the drill top. This same arm has a lift block which engages the under side of the drill pulley so that the handle can be used to both lower and raise the drill point.

Assembling the Power Drill

A pair of 3 inch pulleys were set between strips nailed to the edges of the upright and mounted on a ⅝ inch birch dowel. The thick cotton cord belt runs around the drill pulley, over these two pulleys and then to the power source. The lower end of the upright is shaped to fit into the top of a cast iron standard which was made to support an early model jig saw of the foot treadle variety.

After cutting the arm to the shape shown, bore holes ⅝ inch larger than the exact diameter of the hand drill you are to use, then babbitt these with the drill in place, but with the shank oiled to prevent sticking. You will need to remove the chuck to insert the drill if the type shown is used.

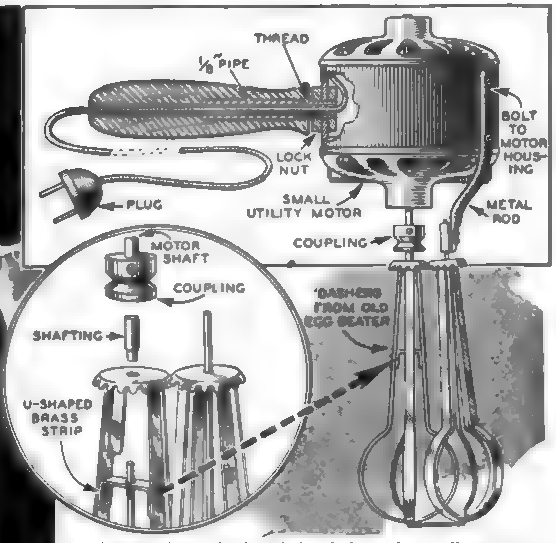
The wooden pulley forced onto the drill handle must have its center carefully bored out to make a snug fit. Otherwise no extra precaution of any kind will be needed. The project is ideal for the home shop fan to utilize a bit of ingenuity to save some money.

Of course this adaptation in no way interferes with the normal use of the drill, although it is suggested that the pulley be left permanently on the ferruled handle.

It will be a good idea to apply a little machine oil to the bearings occasionally. The drill can be powered from a line shaft or hooked directly to a quarter horse motor mounted on the floor.

Handy Electric Mixer from Old Motor

As illustrated here, speed of motor is controlled by pressure on the foot rheostat taken from electric sewing machine.



Constructional details of the dasher. A coupling connects one dasher to the motor shaft, while the other dasher is held rigid by means of a metal rod bolted to the motor.

A "HOME-MADE" electric mixer can be easily constructed by utilizing the dasher and lower gears of an ordinary egg beater and a discarded sewing machine motor and rheostat. Any small utility motor of sufficient speed and power is suitable. The beater or mixer illustrated was constructed as follows:

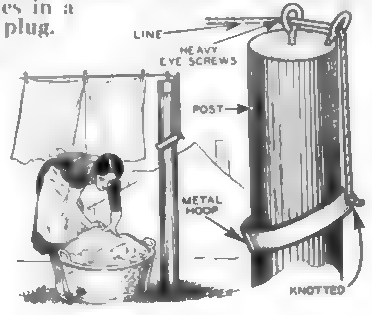
A shaft coupling was made from the motor pulley into which was inserted a short section of shafting. The other end of this shaft was turned down to fit into one of the geared dashers. The other dasher is held in mesh by a rod attached to the side of the motor housing and to the dasher itself.

To obtain sufficient rigidity, the driving dasher, or the one attached to the motor shaft, is reinforced by inserting a "U" shaped piece of metal inside the dasher, about three inches below the gears as illustrated in the sketch. As can be noted from this sketch, a small hole is drilled through the piece of metal and the rod upon which the dashers are mounted passes through this hole and is thereby held rigidly in position. The speed of the mixer is controlled by the rheostat as shown in the photograph.

The handle attached was taken from an old hand drill and is mounted on a short section of $\frac{1}{8}$ in. pipe. The pipe is inserted through a hole drilled in the motor housing and is held rigid by a locknut on the pipe outside the housing and another inside the housing. The electric cord passes through this pipe. For details consult the drawings above. The wire from the motor terminates in a bayonet plug.

Simple Kink to Keep Clothesline Tight

HANGING up clothes proves a severe ordeal to most housewives and the most trying item in the task is that of keeping the clothesline taut. Here, however, is a way to remedy the situation, involving a few simple parts. Bring the clothesline through a couple of screweyes on the top of the clothesline, as illustrated in the accompanying drawing, then hook the end onto a metal hoop. This hoop should be about an inch and a half larger in diameter than the post so that it will grip firmly to maintain tension. Pulling down on the hoop tightens the line.



Electroplating MAKES OLD

You can earn extra money revamping silverware for neighborhood housewives.

Here's the layout of the parts you will need for the electroplating job. Note that objects to be plated are suspended in the plating solution from rod across center of vat.

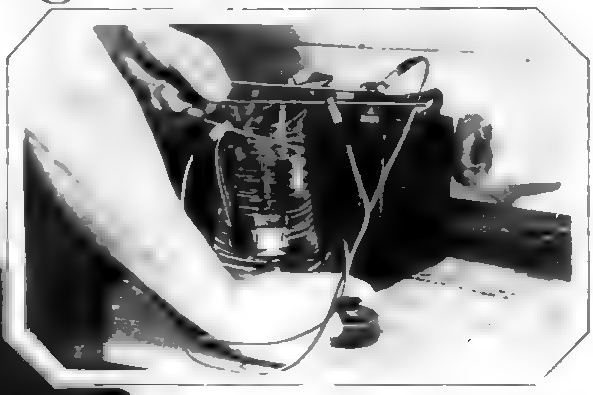


Fig. 1. In case you have no plating vat available, an ordinary water pitcher can be pressed into service. Voltage from storage battery should be cut to one and one-quarter with the old radio rheostat.

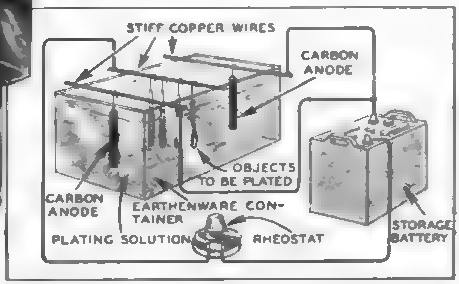


Fig. 2. Wiring diagram for the electroplating set-up. Good hard carbon anodes should be used, but carbon pole from old dry cell, thoroughly cleaned, will serve in emergency.

SILVER is a soft metal and sooner or later tableware, no matter how well taken care of by the housewife, will become scratched. While silver polish may remove some of these scratches, a scratch does not have to be very deep to be beyond repair from the standpoint of mere polish. So it behooves the home mechanic to find some other process.

Contrary to the general impression, scratched silver cannot be restored by silver plating. This does not fill up the tiny indentations as many suppose. The only remedy for this condition is re-buffing and to re-buff you will need a high-speed motor with a soft four or five-inch cloth wheel and some rouge such as that used by silversmiths. This rouge is applied to the wheel while it is at high speed, plenty being put on.

In actual polishing, the article to be worked upon is held firmly in the hand. Press it against the wheel and work downward AGAINST the direction of motion, as illustrated in Fig. 3. Care should also be exercised to keep the article moving in as straight a line as possible to keep the grain of the polish straight. Cross polish will destroy luster. After polishing, each article should be washed in warm water to remove traces of the rouge.

In the case of the cheaper silver plate, a time is always reached where re-plating is necessary if appearances are to be preserved. The home mechanic may either buy the chemicals and do his own plating or he may purchase the solution already prepared from a local plater. If the mechanic is going to mix his own solutions, he must bear in mind at all times that he is dealing with some of the most deadly chemicals known. Death by these poisons *comes sure and fast*, so children should be kept away. Nor does one have to receive the poisons into the body through the mouth for they may enter through cuts and work havoc. The fumes (in sufficient volume) from hydrocyanic acid gas are deadly. In the plating job rubber gloves should be worn and the stunt carried out in a well-ventilated room or out of doors.

SILVERWARE *look like New*

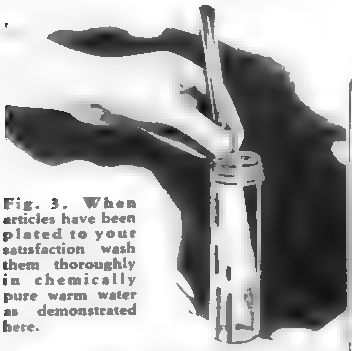


Fig. 3. When articles have been plated to your satisfaction wash them thoroughly in chemically pure warm water as demonstrated here.

Fig. 4. In gold plating inside of cocktail cup, suspend iron electrode in center in method shown.

Fig. 5. When polishing silverware on a buffing wheel, press the article against the wheel and work downward against the direction of motion. Move in a straight line, keeping the grain of the polish straight at all times. Cross polishing destroys lustre.

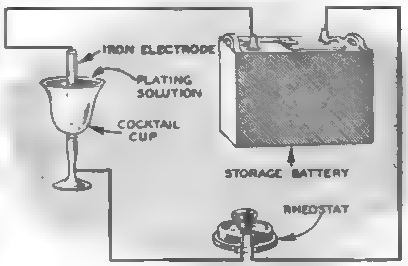


Fig. 6. With this simple circuit you can gold plate inside of cocktail cup and greatly enhance beauty and cost. Be sure to fill cup to brim with plating solution. Rheostat controls plating speed.

Assuming that the articles to be plated have been thoroughly cleaned and placed in a container of chemically pure water to await plating, the mechanic proceeds to prepare his silver plating solution as follows: One ounce of silver chloride is rubbed up with water to form a thick paste. Six ounces of cyanide of potash, *one of the most deadly poisons known*, is then mixed with a half gallon of water. This done, the paste previously prepared is mixed in and the solution stirred until it is thoroughly dissolved.

If all of the solution is not going to be used immediately, part of it is placed in glass bottles (colored glass is best) and set away in a dark place.

The mechanic will be fortunate indeed if he has anything that will serve as a real plating vat. In an emergency a glass storage battery jar or an ordinary water pitcher will serve beautifully. (See Fig. 1.) While it is best to use pure silver anodes, this is quite beyond the average mechanic and good hard carbon anodes may be used instead. No carbons cored with the rare earths should be employed, however.

In a real pinch, the carbon pole may be removed from an old dry cell but the mechanic should be sure that it is clean by grinding off all of the old surface on an emery wheel.

For silver plating, a storage battery should be used. The voltage should not be permitted to rise in excess of one and one-quarter volts. If a voltmeter is not available the best thing to do is to obtain an old radio rheostat such as the type used with the old 201-A, six-volt tubes. If such a rheostat is used and all of the resistance placed in the circuit, about one volt will pass. The higher the voltage, the more the current and the faster the deposit. Fast deposition is bad.

Some time ago, the writer took some ordinary cheap metal cocktail cups that were bought for seventy-five cents each and gold plated their interiors. This greatly enhanced their beauty and made them worth many times their original cost.

Of course, it was impossible to plate gold directly on the surface and it was therefore

(Continued on page 156)

SPARKS from the RADIO EDITOR

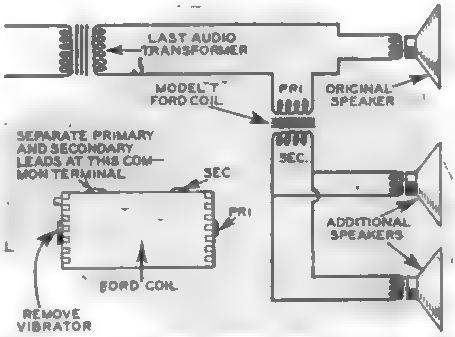
Edited By L. B. ROBBINS

Hooking Extra Speakers to Receiver

THERE comes a time when one wishes to hook up an additional speaker to his receiver. With the dynamic or magnetic type of speaker it is not satisfactory to do the stunt in the ordinary manner of simply putting extra speakers in series or parallel.

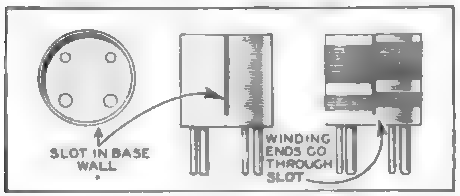
One good way to do this is to supply a sort of additional secondary to the final audio transformer as shown at the right. This can be done by using a Ford spark coil (Model T) as illustrated.

Remove the vibrator from the coil and then take the top rear button contact from the case. It will be seen that this has two internal connections. One is one primary wire and the other is one of the secondary wires. Separate these and provide a separate connection for one or the other. Then connect the coil primary in series with the audio secondary as shown, and the secondary of the Ford coil in parallel with one or two speaker voice coils. With a receiver of any ordinary output this scheme will prove OK.



With primary of Ford coil in series with set speaker, additional speakers are hooked in parallel to the secondary.

Easy Way to Wind Tube Base Coils



Instead of drilling holes in tube base, slot it as shown above and run wires through the groove. Use jeweler's saw.

HERE is a simple little stunt to try out when you wind your next batch of tube base coils. The amateur invariably drills four holes in the shell through which can be run the ends of the primary and secondary windings. If the number of wire turns has been correctly estimated all is well. But, if considerably more or less wire is needed then the holes are way out of position.

The best way to overcome that is to saw, with a fine jeweler's saw or similar tool, a vertical slot down the length of the shell as suggested. Then the windings can be large or small as the case may be, and a place will always be found for inserting the winding end. In case the lead has a tendency to slip up or down a very small notch in the slot edge will cure this trouble.

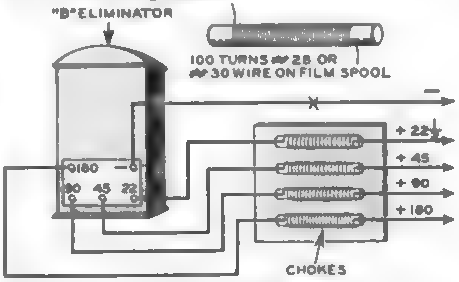
Solder the ends in usual way.

Filter Out Hum From B Eliminator

MANY of the older style B eliminators use a half wave rectifying tube. In these cases filtering is not always perfect enough to entirely cut out the AC or pulsating DC ripple. By the use of several small chokes, one in each voltage line, the remaining ripple can be often reduced or entirely eliminated.

Procure a few wooden film spools, remove the metal flanges and drill a very small hole through each end of the wood. Using these holes as fastening terminals, wind each spool with about 100 turns of No. 28 or No. 30 DCC wire. Sew the ends of the wire through the holes just mentioned, then cover the windings with Duco.

Fasten as many of these chokes to a small board as there are plus terminals to the eliminator, and wire them up as illustrated in the drawing below.



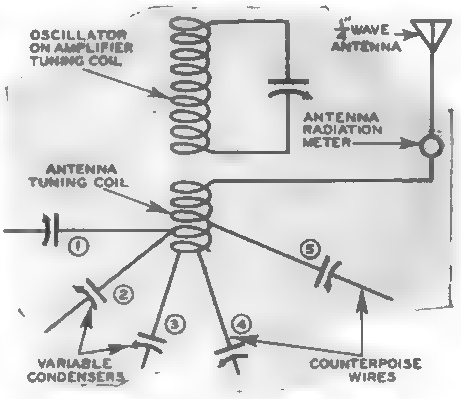
D.C. ripple is ironed out by inserting chokes in positive leads from eliminator. Better results may be secured by adding extra choke in circuit at point marked X in negative lead.

Kink to Tune Your Transmitter for Maximum Radiation

ORDINARILY in antenna systems which employ a counterpoise for a ground, the counterpoise wires terminate in one wire attached to the outer end of the antenna tuning coil. Invariably the system is tuned by one condenser.

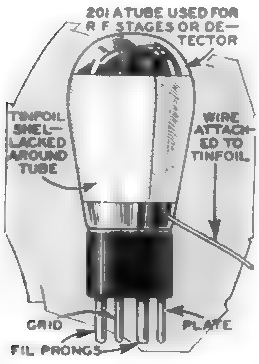
With the scheme illustrated in the accompanying drawing, radiation can be boosted considerably. Several counterpoise wires are used, each one being attached directly to the end of the coil at several points on the turns. A variable condenser is inserted in series with each wire. Now in tuning condenser No. 1 is operated to show maximum radiation in the antenna meter and left there. Then No. 2 is used to increase the reading of the meter if possible. And so on with the several condensers used; going back to one or the other to get the maximum radiation.

The wire lengths and the condenser capacities can vary. The idea of the whole scheme is to use one condenser as a vernier against the other until a definite maximum capacity is reached and maximum tuning.



To obtain maximum radiation when series of counterpoise wires are employed, cut each wire and insert condenser. Each condenser is then tuned for maximum radiation on meter.

Improvised Screen Grid Tube



Improvised screen grid tube is made by laying wire against the glass and wrapping with tinfoil—after shellacking.

THE burn-out of a 222 screen grid tube need not hold up the use of the receiver if a 201A, 112A or 171A tube can be procured. An improvised screen grid affair can be made by the use of a small sheet of common tinfoil and piece of fine wire.

Bare about three inches of the wire and lay it along the length of the glass of the tube. Then shellac the glass and allow it to become tacky. With the wire in position, wrap the tinfoil about the tube as shown in the sketch, pressing it down well with the fingers.

Now put the tube in the socket and, using the plate voltage normal to the use of the tube, apply the usual screen grid voltage to the wire attached to the tinfoil. This will run from 22½ to 67½ volts, depending upon the plate voltage used.

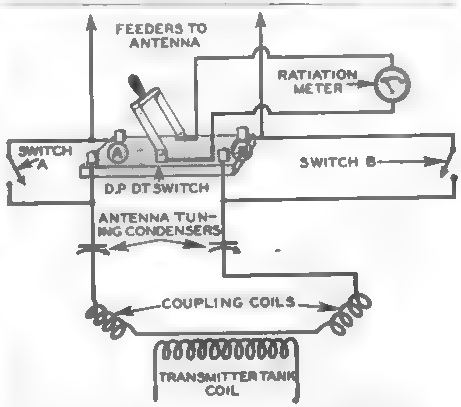
In the majority of cases you will immediately note the gain in detection or amplification. Of course much depends upon the screen voltage used and one good way to vary this by steps is to insert a variable 300 to 400 ohm resistor in series with the screen voltage source. This stunt can also be used with the 2-volt 230 tube as well as with the others.

Using 1 Meter in 2 Feeder Wires

RADIATION meters cost money and a meter in each feeder is practically necessary to insure balance. Here is a way, however, that one meter can be used successfully in both feeders.

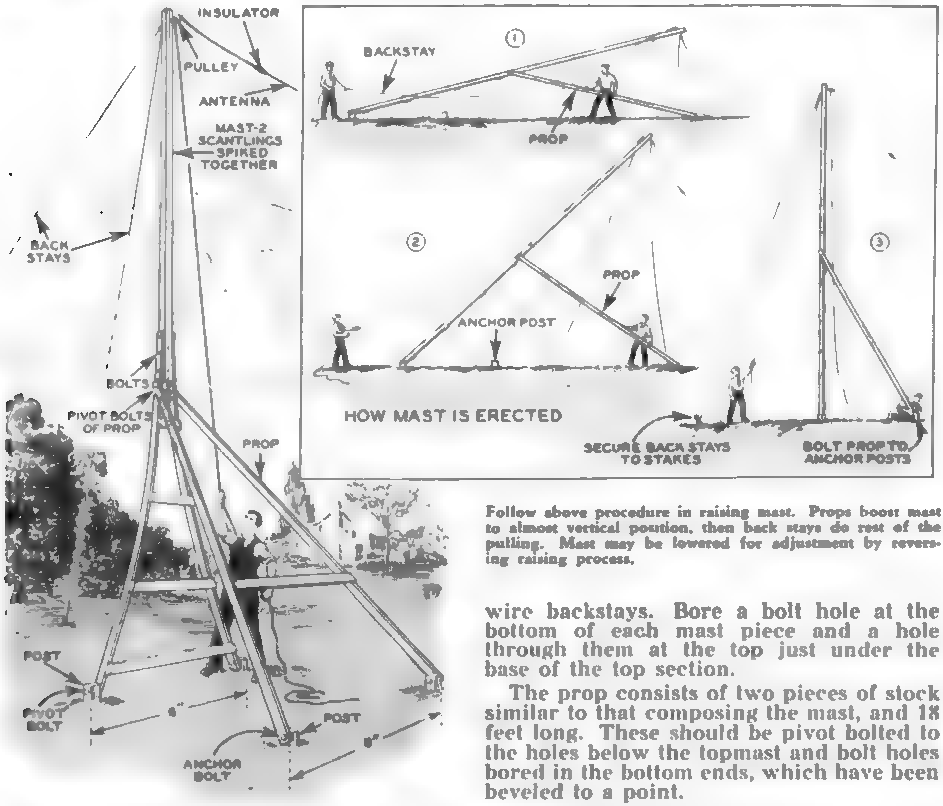
Place a fairly large DPDT switch between the feeders and connect the meter to the arm terminals. Then cut the feeders opposite the switch. Connect the cut ends of one to point A of the switch and the other feeder ends to point B. Also shunt point A and B with two small knife switches. That's all there is to it.

Throwing the switch arm to A and opening the knife switch B shows a reading on that feeder. Reverse the process to get a reading for the other feeder. Readings can be balanced by the variable condensers in the feeders. Close the knife switches when operating the transmitter.



Radiation meter is used for any feeder by throwing switch to that side and opening knife switch. Reverse process for other feeder. Knife switches are normally closed.

It's Easy to Raise, Lower This Sturdy Self-stepping Mast



Here's the layout of the mast, ready to take the antenna rigging. Support against high winds is provided by the two props and the two backstays. Set posts 3 feet in ground.

Follow above procedure in raising mast. Props boost mast to almost vertical position, then back stays do rest of the pulling. Mast may be lowered for adjustment by reversing raising process.

MASTS have long been a hobby with the editor. Here is one that has been worked out to save M-M radio fans much hard labor in the task of erecting and lowering the pole for adjustments.

The mast shown in the accompanying drawing can be constructed of four lengths of 3 inch "scantling," each piece of standard 18 foot length. First nail two lengths together for the top section. Paint the stock first and then nail through the stock from each side, spacing the nails about 6 inches apart. Cap the tip with tin or zinc.

Assembling Your Mast

Now starting at the lower end, temporarily nail an 18 foot piece of stock at each side, lapping them up four feet. When in place drill several holes the length of the lap and insert long bolts so a strong joint can be made. Then spread these two lower pieces out 6 ft. apart at the bottom and brace them with horizontal and cross braces as shown. Place a halyard block at the mast tip and a large eyebolt for the two wire backstays. Bore a bolt hole at the bottom of each mast piece and a hole through them at the top just under the base of the top section.

The prop consists of two pieces of stock similar to that composing the mast, and 18 feet long. These should be pivot bolted to the holes below the topmast and bolt holes bored in the bottom ends, which have been beveled to a point.

Erect Mast on Level Ground

Choose the location for the mast on level ground and sink two posts slightly over 6 ft. apart. Bolt the mast bottom pieces to these two posts. Lay the mast down nearly flat with the ends of the prop near the tip. To raise the procedure shown in sketches 1, 2 and 3 should be used.

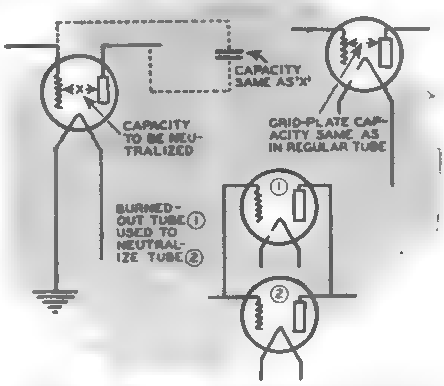
When the mast is vertical the ends of the prop should be bolted to a pair of posts sunk in the ground directly in front of the mast. This gives the mast partial permanent support, further support being gained by two wire back stays fastened to the eyebolt at the mast tip and attached to suitable posts 18 to 20 feet apart and as far away from the rear of the mast. When it is desired to lower the mast it is only a matter of releasing the backstays and then handling the prop in reverse. The mast can be lowered by one man without trouble.

A few cross pieces will suffice to space these prop sides so they will straddle the mast at the top end and widen out to eight feet apart at the base. That's the whole story except painting the entire structure for withstanding the weather and for looks.

Burnt-out Tubes Do Duty as Neutral ng Condensers

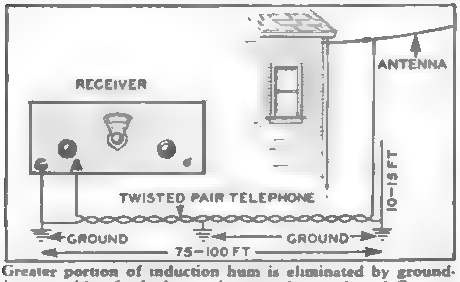
IN NEUTRALIZING receivers or transmitting outfits employing buffer or doubler stages it is the custom to use small, midget condensers to equal the capacity of the plates and grids of the tubes. In lieu of such condensers one can make use of the internal capacity of similar tubes as shown in the sketch.

For instance if you are using a 245 type tube and wish to neutralize it just use another 245 with a burned-out filament as the neutralizer. Arrange a second socket near that holding the live tube. Wire the grid and plate posts of this second socket to the grid and plate posts of the socket holding the live tube to be neutralized. Then, with the good tube in operation insert the burned-out tube into its socket and, all things being equal, you will gain perfect neutralization without adjusting a variable condenser.



In place of neutralizing condenser shunt burned-out 245 tube across terminals of good tube. Both have same capacity.

Simple Kink to Reduce Annoying Inductive Hum in Broadcast Receiver

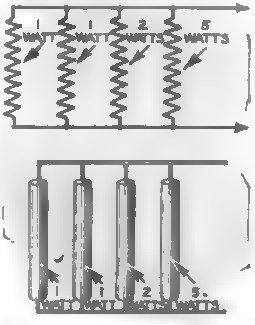


Greater portion of induction hum is eliminated by grounding one side of telephone wires running to A and G posts.

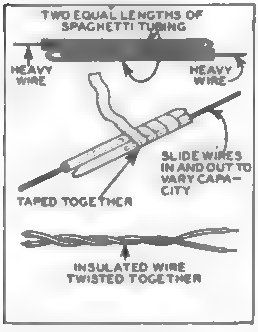
HAVING trouble with an inductive hum in your receiver? Then here's a little kink that might help you out. Lay hold of a length of twisted telephone wire and connect to one end of the terminals on the broadcast receiver, and ground one side at intervals as illustrated in the drawing. Then when the wires issue from the lead-in insulator run them parallel up the side of the house, for about 15 feet. While not always successful, the stunt ought to cut down on induction hums considerably, but some trouble in tuning might be experienced.

Paralleling Resistors to Carry Higher Currents

IN BUILDING transmitters, resistors are sometimes desired that will carry more current than the one you may have on hand. If enough resistors are available they can be paralleled in the circuit to pass the required current. Suppose a 9-watt resistor is desired, but only ones of lower wattage are at hand. Therefore by inserting two 1-watt, one 2-watt and a 2-watt resistor and connecting them in parallel, 9 watts are obtained. Such a hook-up distributes the load on the resistors and eliminates danger of breakdown when a high current is applied.



Follow this scheme of hook-up.

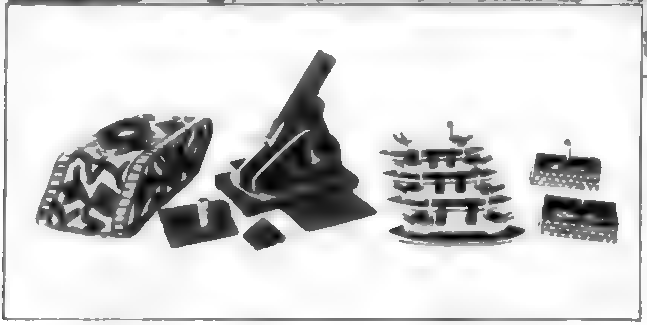


Vary capacity by varying wire.

Pygmy Balancing Condensers

HERE is a way for the "ham" to save a penny when in need of neutralizing or balancing condensers of very small capacity. They will do nicely for neutralizing pentode tubes in push-pull and hookups of like nature. One method is to use two pieces of wire, each one of which is about 3 inches longer than needed. The wire should be quite stiff and bare. Cut two pieces of "spaghetti" about 3 inches long and seal one end of each. Then push a wire into each piece and lay the two spaghetti pieces parallel and wrap them with tape. The wires will thus lie parallel and form a small capacity which can be changed by sliding each wire out of its sheath the required distance. A small neutralizer may also be made by twisting two pieces of insulated wire together for a distance of two or three inches.

FIGHT Artillery DUELS

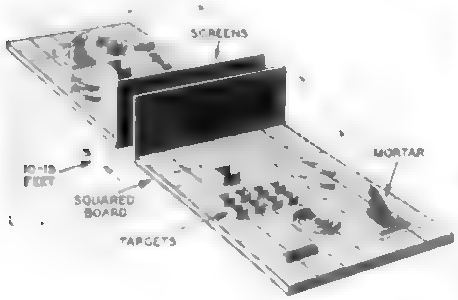


Opposing "forces" are here seen engaged in a deadly artillery duel. When a tank, battleship, or fort is struck by direct blow, it explodes and is counted "out of action."

by

PAUL R. RANNIE

You fight real, deadly battles on a small scale in these fascinating war games, which have all the strategic elements of nation-against-nation campaign. Exploding battleships, forts and tanks and an accurate long-range mortar compose your fighting forces, built as described in this article.



Above photo shows full fighting equipment for one side, ready to deploy for battle. Fig. 1, at left, shows one war game that will prove fascinating. Targets are constructed as shown in Fig. 8, and arranged on a squared board for the enemy to shoot at. Mortars have a range of five to twenty feet and are amazingly accurate.

MANY of us have been fascinated by photographs or moving pictures of huge artillery pieces sending their shells screaming up into the air on their way toward a target perhaps out of sight beyond the horizon. The gunners usually do not see the target, but fire in a certain direction and at a certain elevation from data furnished to them.

The toy mortar shown in the photographs and drawings will shoot small soft clay balls in the same manner as the big guns and with surprising accuracy. It can be used as the basis of some interesting games that will attract many of the older folks in addition to the youngsters. Easily constructed targets which explode (mechanically speaking) when hit, a moving target and others are also part of the equipment described.

in Fascinating WAR Games

The construction of the mortar is shown in Fig. 2 and the photographs. It will be noted that rubber bands and the old catapult principle are used. The tension of the rubber bands can be varied depending on the amount of space available for the games. The maximum range may be varied from a few feet to over 20 feet. The elevation pointer, the barrel, and the large washers are made of sheet tin. The barrel has no function except to add to the appearance.

Making the Long-Range Mortar

The catapult arm should be made of fairly hard wood. The hole in the arm which receives the shot is triangular in order to insure uniform and firm seating of the clay balls. The base has three points for contact with the table or floor to prevent tilting, or a thin board may be fastened to it and weighted down with books to prevent any shifting of position. The deflection and elevation scales are easily made by drawing with India ink on white lacquer and covering with a coating of thin shellac. The clamp which holds the elevation is important because the "recoil" of firing would otherwise change the angle.

The shot are made from the type of modeling clay that does not dry out. The balls may be made in any size, but ⅝" diameter is about right. Fig. 2 shows equipment for making the shot uniform in size.

The mortar is the main idea of the games and should be constructed to fire as accurately as possible. At a range of 12 to 15 feet, most of the shots should fall in a 2 or 3-inch circle. The mortar is intended to be used at angles over 45 degrees. This makes it possible to fire at targets disposed horizontally and does not require high velocities which would be rather dangerous to use indoors.

The "explosive" targets, which fly to pieces when hit, are shown in Figs. 4 and 7, and the photographs. The construction can be easily understood from the photo, Fig. 3. They "explode" when a shot strikes from above and causes them to bend down slightly at the canvas hinge. The rubber band snaps the two sides up into a "V" shape throwing the turrets, fort, cannon, etc., into the air.

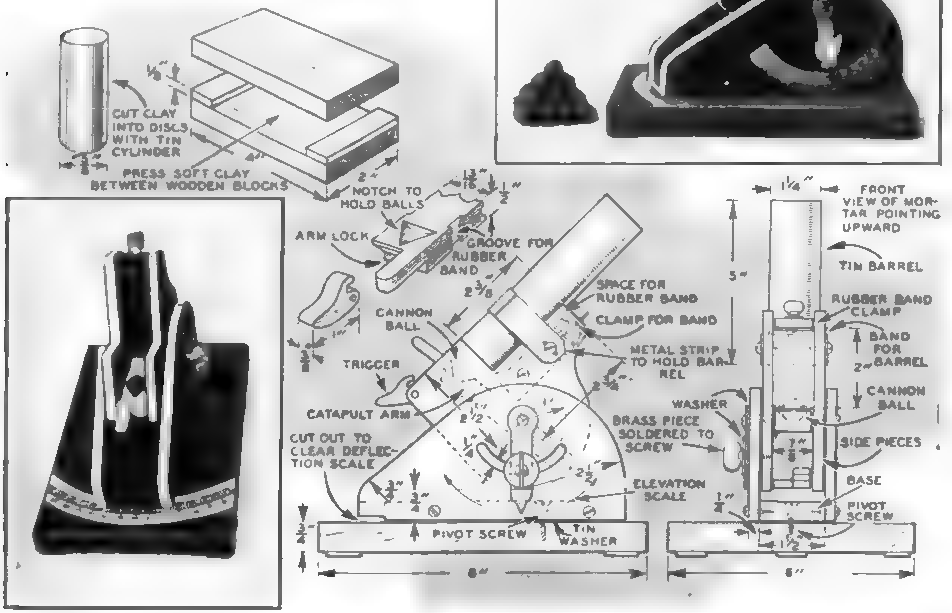


Fig. 2. The "enemy's" lines are bombarded with this little mortar, which heaves a clay ball with a catapult action. The cannon balls are made by pressing modeling clay between two boards, cutting it with tin cylinder and rolling into ball.

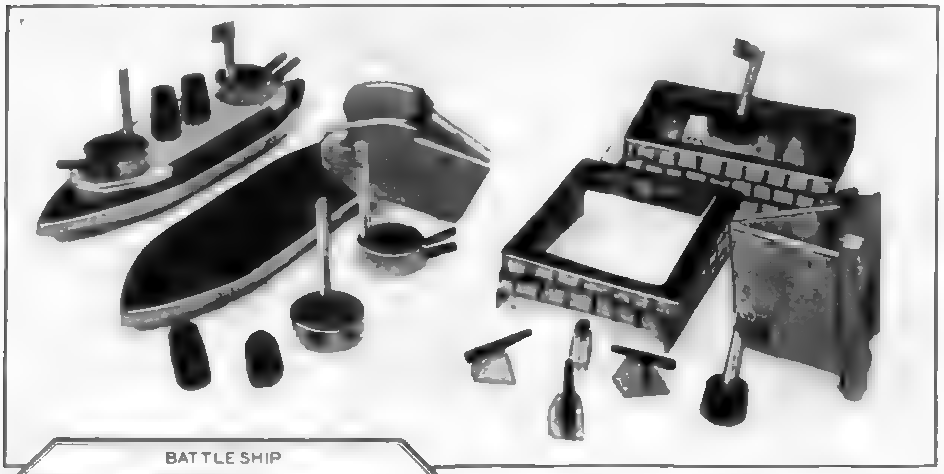


Fig. 3. View of forts and battleships here show "before-and-after" a direct hit. Shell dropping on exploding deck, which is hinged in middle, causes rubber band to snap ends together, throwing guns, turrets, funnels and masts in air.

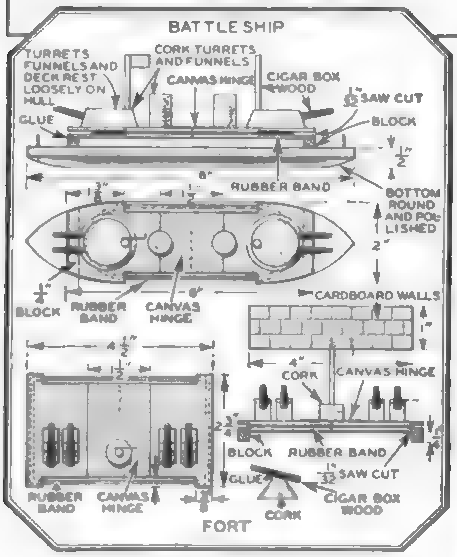


Fig. 4. Plans for battleship and fort. Note that explosive deck rests on two blocks at ends. Band passes around saw cut.

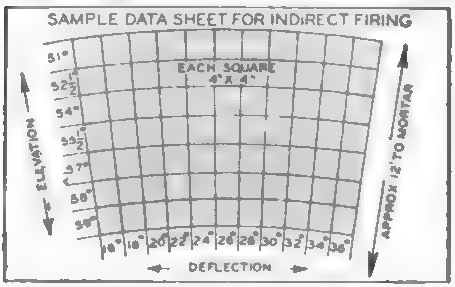


Fig. 5. For indirect firing, lay out an area like this on the floor. To get figures for setting angle of deflection and elevation on the mortar, try several scattered shots, then record your results. Use this as firing data to direct shots.

The sensitivity of the exploding mechanism may be adjusted by changing the angle which the two sides make at the hinge. Leather, cloth or canvas may be used for the hinge. The bottoms of the battleships are smoothed so they may be pulled over the carpet or floor if desired by the small clock works tractor to be described below. The parts of the ship and fort are not fastened together except where indicated, in order that they may fly to pieces when struck by a shell.

Clock Works Powers Novel Tank

The moving target is shown in Fig. 7 and the photographs. It is a small clock works-driven tractor and may be used as the driving mechanism of a tank, as a target itself, or for towing battleship targets. The construction is simple. The clock works is held in place by pressure of the parts above and below it. The rubber band around the driving wheel increases its traction on the carpet or floor.

A single wheel is used in front in order to keep all wheels on the floor at once. The screweye is the simplest means for keeping the rubber band belt in place.

The stopping device is shown in Fig. 7. Note that a loop of wire is held against one of the clock wheels by a small rubber band. Pressure on the end of this wire, which extends through the top of the tractor, disengages it from the wheel and the tractor starts. When the deck is struck by a shot it flies up into the air, the wire comes up, and the tractor stops.

The tractor should move rather slowly. About ½ to 1 inch per second is a good speed. This can be adjusted or changed by varying the size of the wheel on the minute hand shaft. It will also be found

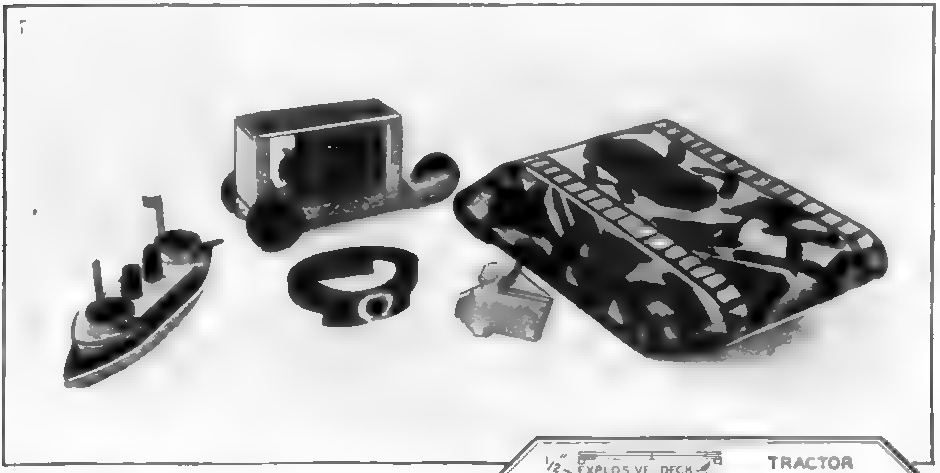


Fig. 6. Moving targets will make games much more fascinating and develop good marksmanship. Tractor tows lines of ships as illustrated. Cardboard "armor" fits over tractor to convert it into tank. Turret and explosive deck rests on top.

that oiling the smallest wheel in the clock, (usually the escapement wheel) increases the speed a great deal.

A tank may be made of cardboard as shown in Fig. 7, and the photographs. The top opening should be made to rest on the corners of the top of the tractor. A small turret, as shown, can be made to rest on the top of the tank over the explosive deck of the tractor. Thus when a direct hit is made on the turret of the moving tank, the turret flies up into the air along with the tractor deck and the tank stops.

If the "explosive" targets described above are not desired, less complicated ones are easily made from cardboard or tin in the shapes shown in Fig. 8. Make the bottoms of heavy wood or pad with cloth to prevent the balls from bouncing out.

How War Games Are Played

There are many kinds and variations of games that can be devised for the mortar and targets. The simplest would be a contest for accurate shooting. A good way to conduct such a contest is to move the target after every 3rd or 4th shot, or have a number of targets and allow 3 or 4 shots at each. If a box target is used, the total hits can be counted and if an explosive target is used, count the shots required to explode it. Since the mortar does not always duplicate its shots, depending on the care used in making the balls, loading and firing, a contest using 10 to 20 shots from one position could also be tried. These are only a few suggestions; many other contests can be readily devised.

Rules for some special games are as follows:

1. *Coast Artillery.* Locate the mortar on

(Continued on page 157)

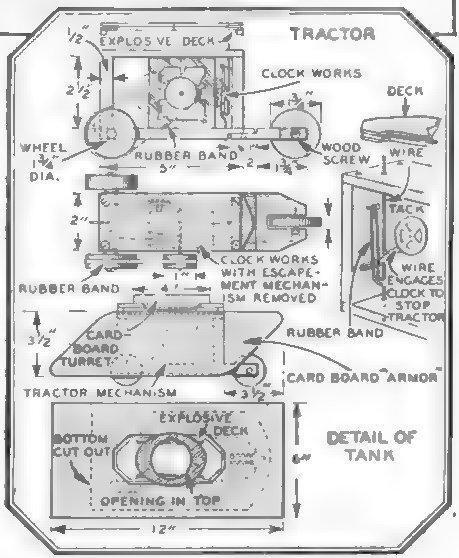


Fig. 7. Tractor has clock works in interior. Rear wheel is mounted in adjustable axle so that tractor can turn curves.

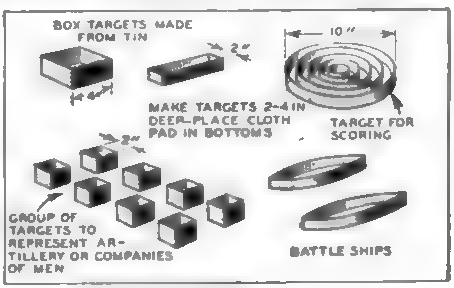


Fig. 8. If you don't want to build explosive targets, less complicated ones are easily constructed from cardboard or tin in the shapes shown above. They should be deployed about the battle area as is illustrated in Fig. 1.

The LONG HARLEQUIN

As sweet a "baby" as ever turned a prop! The "Harlequin" sets neatly on its mount, and because of the balance and symmetry of its design, presents little difficulty in cowling to a perfect streamline. It has proved itself in service.

Weighing 90 pounds and delivering 30 horsepower, this powerful air-cooled motor, built up out of stock parts at a cost way below a hundred dollars, is the answer to the light-plane builder's prayer for a thoroughly tested power plant. Harley Davidson cylinders are used.

EVER since this flying game started amateur builders have been confronted with the problem of a power plant. Light engines have always been scarce and high priced. Right today there is a very limited choice for the man who isn't free from the worry of expense.

For some reason there have been very few good light airplane motors built. The famous Bristol "Cherub" has probably been the best in this class, but it, like the others, has been handicapped by the high price. For years determined efforts have been made to convert various automobile and motorcycle engines for use in flying. Some of these, notably the Ford and Henderson, have worked out fairly well, but they had serious limitations. At that, they have done a lot for the amateur game.

When we began building experimental light planes a few years ago we at once ran into this engine problem. The kind we wanted were too expensive and the kind we could afford were not what we wanted. So it was that while building our fourth light ship we decided to build an engine to go with it. From the start we were determined that the engine must have certain features to be practical. It must have only two cylinders. It must weigh under 100 pounds. It must be of the 4-cycle type, be free from vibration and overheating and must develop 30 horsepower or more. Finally, it must have both a low first cost and a low maintenance cost. It looked like quite a task, but it turned out differently.

The first problem was the cylinders. To have them made up was out of the question. It didn't take long to decide that our only chance was

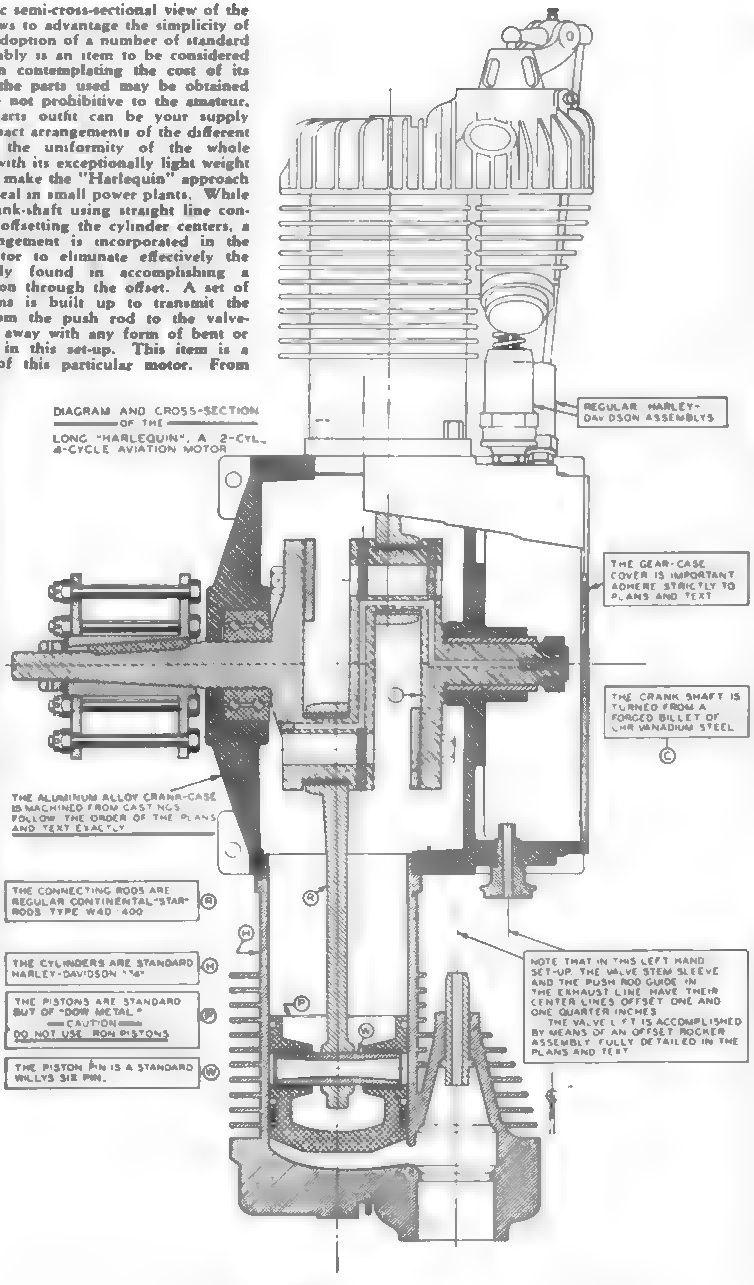
BLUEPRINTS FOR THE HARLEQUIN MOTOR

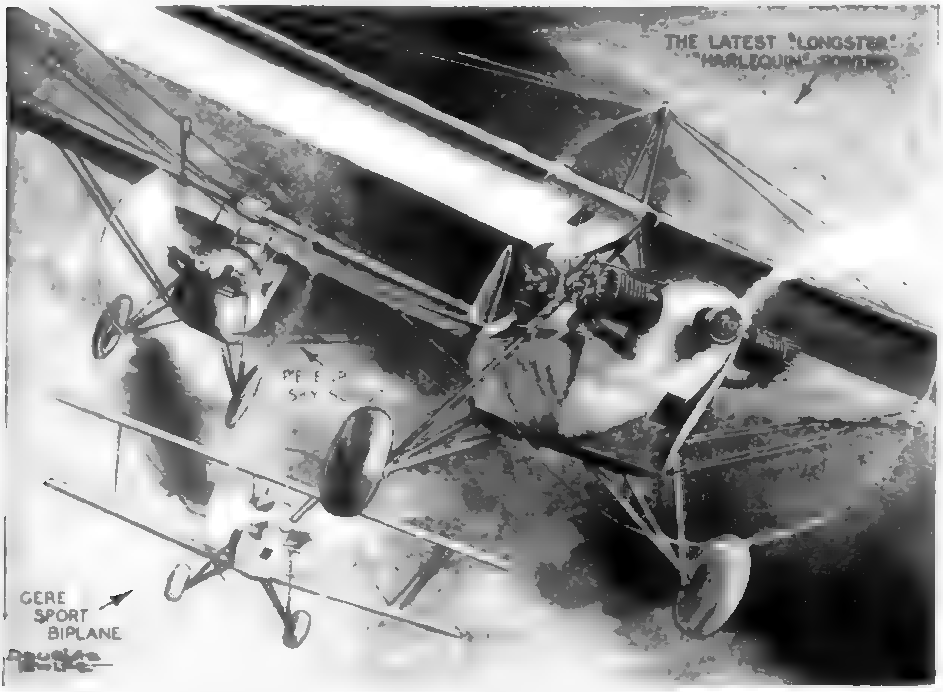
A complete set of full-size blueprints on the Harlequin motor is available from Modern Mechanix and Inventions Blueprint Department at $5 per set. These blueprints are made from the original drawings which illustrate this article and following installments, but they show practically all the parts in actual size, as cannot be done in the small confines of a magazine page. One of the most beautiful and complete sets of draftings we have ever seen. Address the Blueprint Department at 529 S. Seventh Street, Minneapolis, Minn.

MOTOR PLANS

by LES LONG

This diagrammatic semi-cross-sectional view of the "Harlequin" shows to advantage the simplicity of its design. The adoption of a number of standard parts in its assembly is an item to be considered quite seriously in contemplating the cost of its upkeep. All of the parts used may be obtained at prices that are not prohibitive to the amateur, and most any parts outfit can be your supply house. The compact arrangements of the different assemblies, and the uniformity of the whole design, together with its exceptionally light weight and low first cost make the "Harlequin" approach very nearly the ideal in small power plants. While the two-throw crank-shaft using straight line con-rods necessitates offsetting the cylinder centers, a very clever arrangement is incorporated in the plan of this motor to eliminate effectively the difficulties usually found in accomplishing a proper valve action through the offset. A set of offset rocker arms is built up to transmit the lifting action from the push rod to the valve-stem, thus doing away with any form of bent or curved members in this set-up. This item is a distinct feature of this particular motor. From the shaft-gear to the piston pin, the entire line of parts is standard Harley-Davidson. The shaft gear, cam gears, cam stud plates, push rods, valve assemblies, push rod guides, valve guides, cylinders, and Dow metal pistons all are selected from this cycle line. Note the method of preparing the star rods to preserve the straight line thrust from piston pin to crank pin. Another feature to add to the "Harlequin's" list of novelties is the counterbalanced crank-shaft with its drilled oil line. Total weight of the motor is only 90 pounds, which figures out at the rate of three pounds per horse-power, the Harlequin developing 30 h.p. at 2650 r.p.m.

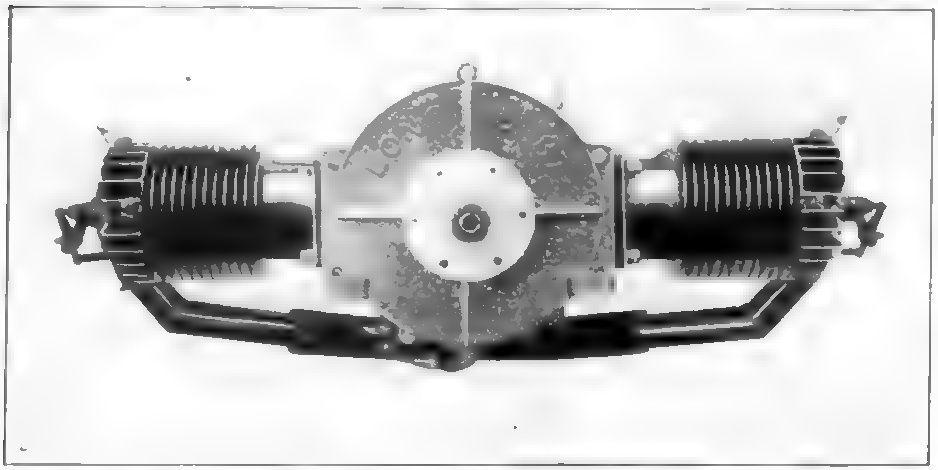




Here's how the "Harlequin" hauls high on three of the light planes whose plans have previously been published in Modern Mechanix and Inventions! The Pietenpol, Gere and the latest Longster trail toot sweet behind this tiny tornado.

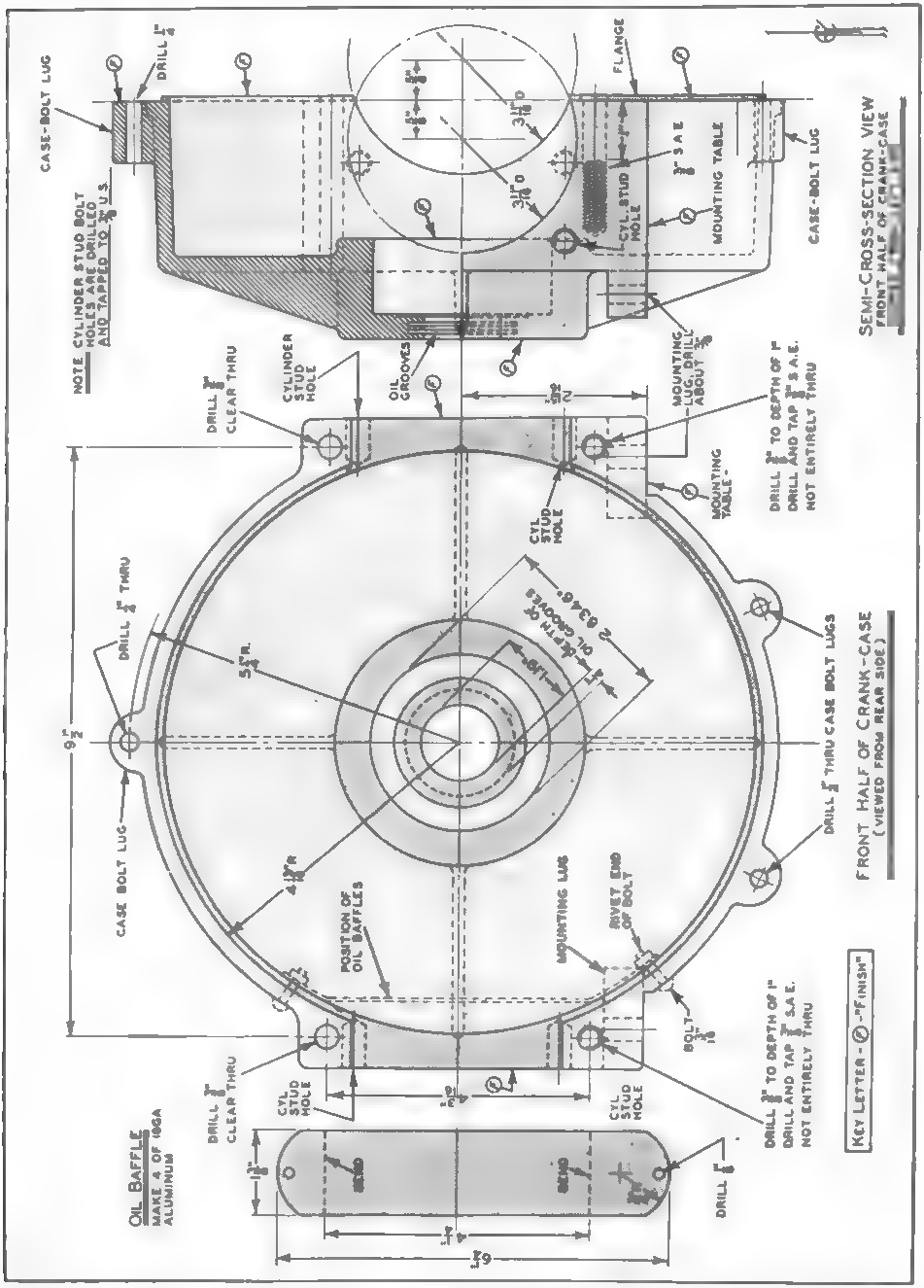
the 74-inch Harley cylinder. They are noted for long life and are low priced and available. The valves are large and the valve chamber allows the best cooling possible to obtain in any design.

With this settled things went ahead rapidly. Crank-case and shaft were designed and made up. Rods, pistons, pump and all accessories were chosen from standard stock parts. This is one of the features of the engine. With the exception of the case and shaft every part in it is available any-



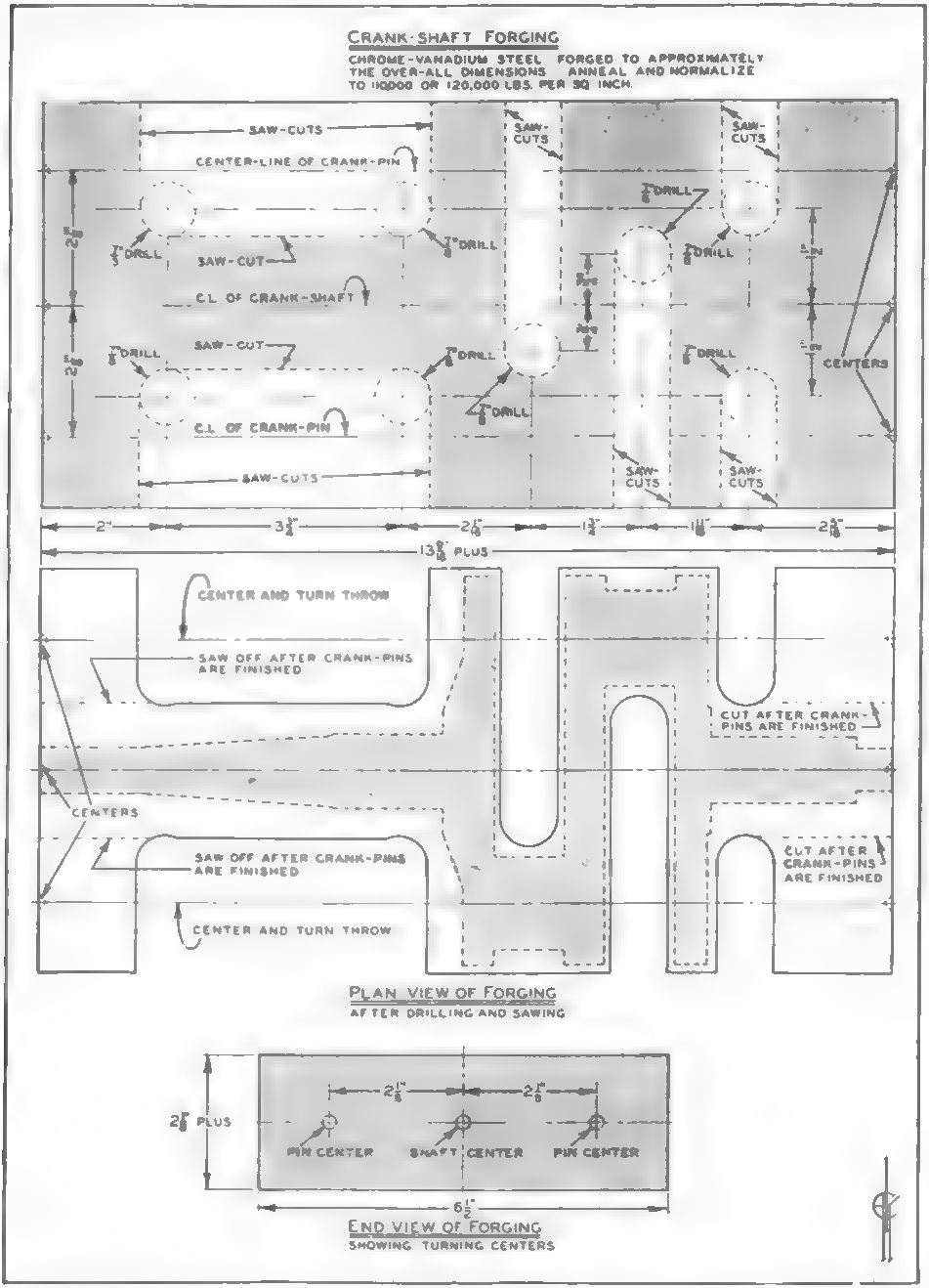
A nifty shot of the "Harlequin," showing off the front half of the cast aluminum crank-case to a sweet advantage.

Here's Front Section of Crank-case; Castings Can Be Secured From Long



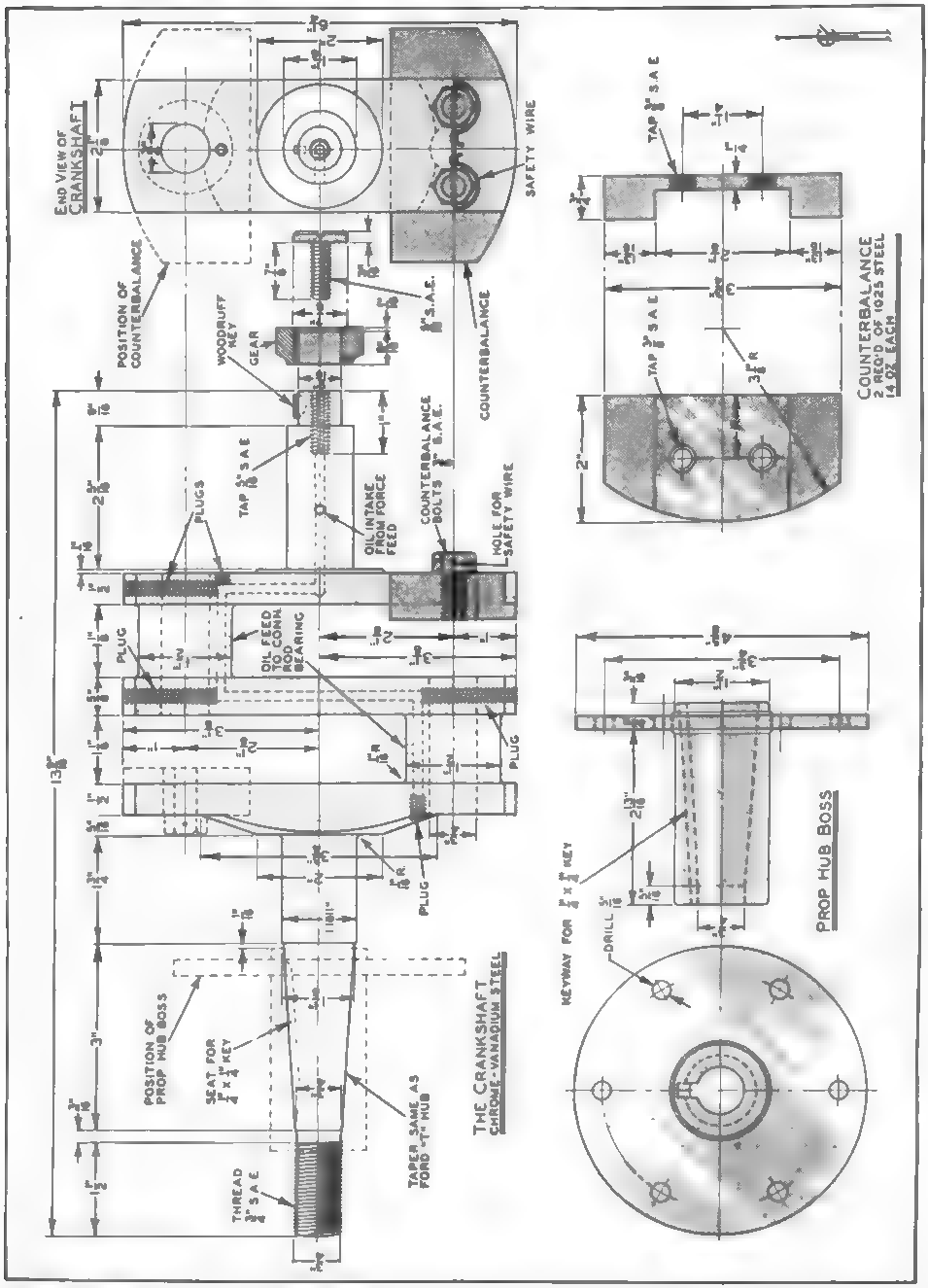
This draft of the front section of the crank-case needs little explanation. With the castings at hand, instructions may be easily understood and followed, with no difficulty. A feature of this design is the set of baffle plates which eliminate the necessity of oil rings on the pistons. Detailed instructions for their installation will be found in following issues. The plans for this motor are so completely done up and elaborately illustrated that it has to be published in three parts.

Crank-shaft Is Work of Art, Turned From Solid Billet of Forged Steel

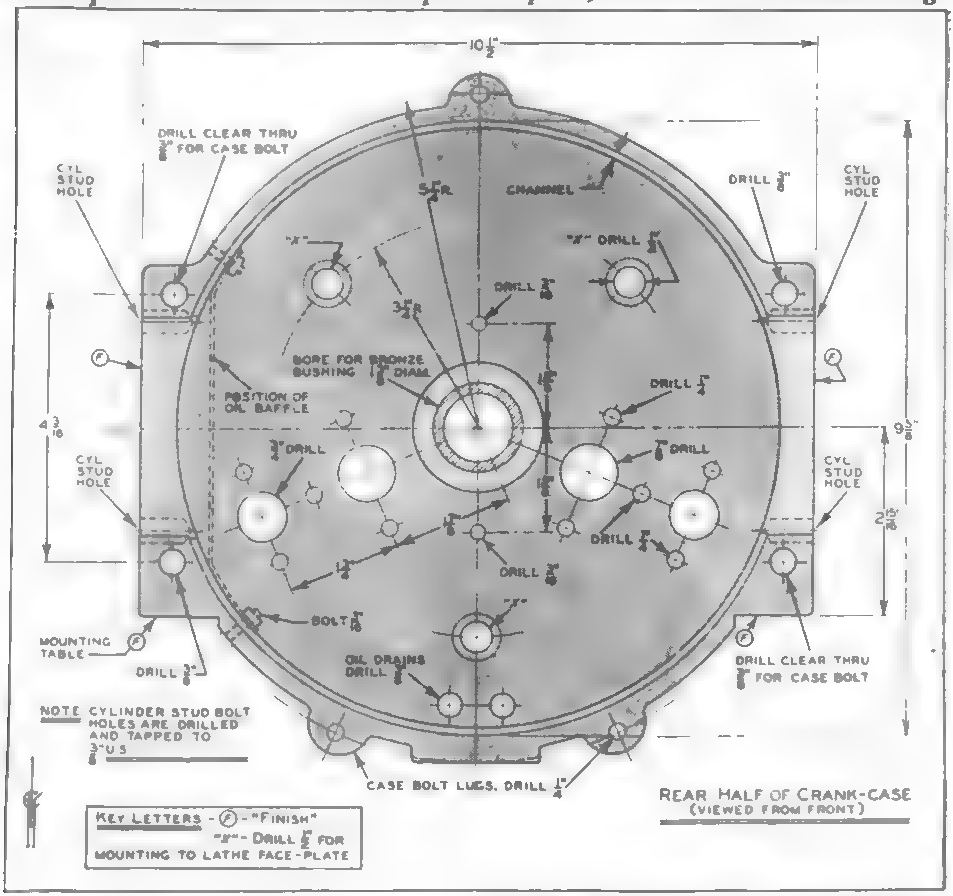


The crank-shaft is turned from a solid billet of steel forged to the formula given. The various steps in preparing and centering the forging for the lathe are quite plainly shown in the draft above. Lay out the drillings and the saw-cuts with care to allow sufficient finish for the turning. The rough billet should cost about $5. Making the crank-shaft is the most time-consuming job of entire motor, but with complete directions given it is not beyond average craftsman's ability

Crank-shaft Can Be Turned on 16-in. Lathe—Not So Difficult as It Looks



Turning the crank-shaft on a 16" lathe requires a bit of time and effort, but is not actually as difficult as it may seem. No dimensions are given for the oil intake from force feed, as this operation must be taken care of in the order outlined in the text. Do not drill this intake channel until the text so indicates! When you have completed this crank-shaft, a thing of beauty if there ever was one, you will have learned as much about machining as several weeks in a trade school could teach you. Follow the drawings and instructions patiently and you will complete the job successfully.



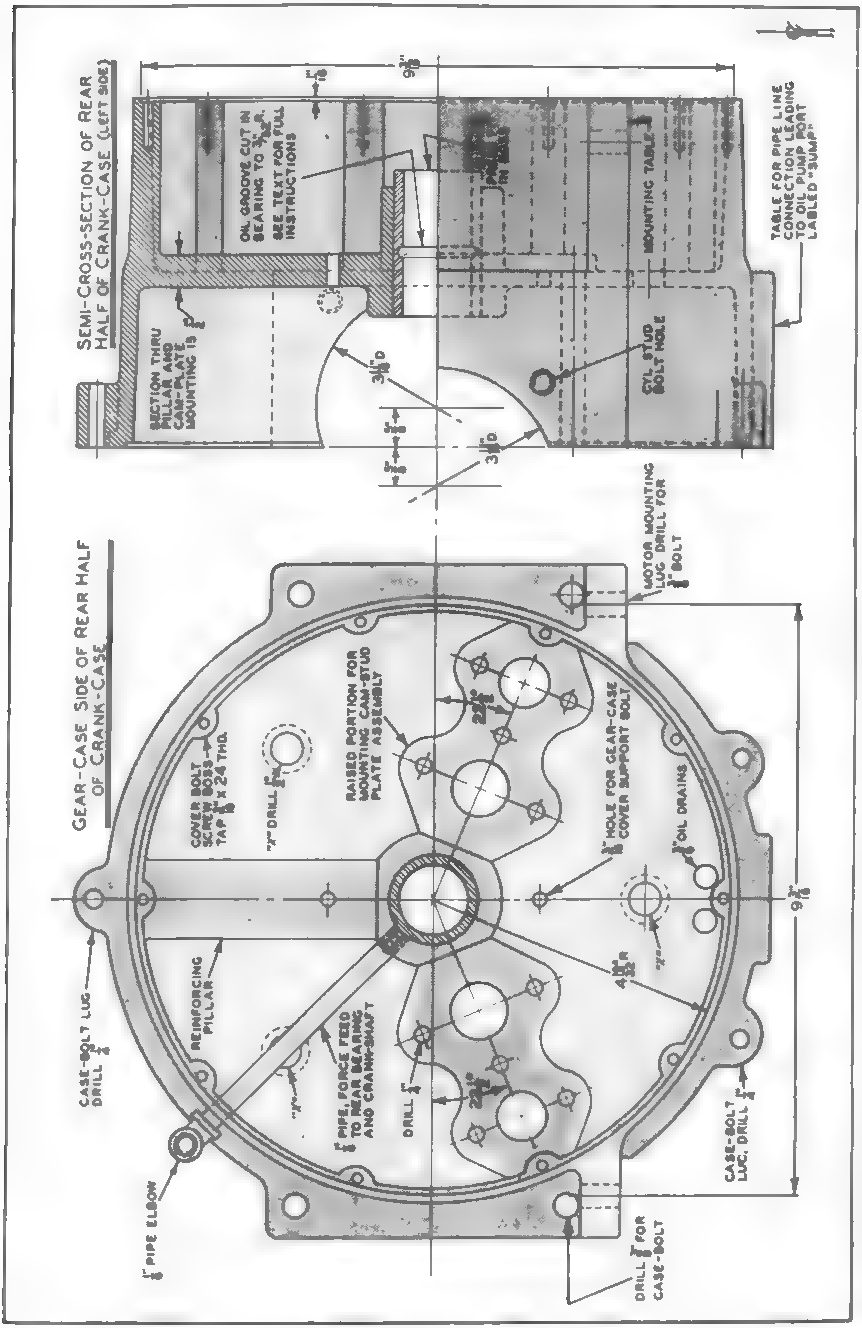
In this installment, all that is explained of this section of the crank-case is the purpose of the set of holes marked "X." When you have centered them, drilled them, and used them as the text directs, stop! Wait for further installments before going ahead. In the meantime, rest your eyes on the Longster at left, coming in for a landing towed by a "Harlequin."

where in the world. Four weeks after the sketches were started the engine was running on the stand, and a week later it was flying. This ought to be some kind of a record.

Slight changes were made as the next three motors were built, since when not a change has been made. It is as near perfection as we believe it can be. It doesn't miss, vibrate, heat nor smoke. It starts easily and we have never had a fouled plug since we started, nine months ago. There has never been a single breakage nor noticeable sign of wear. Best of all, it swings a 5'2" prop for hours at 2,750 without faltering. What more could you want?

The bore is practically 3½ inches and the stroke is 4¼, giving a capacity of 82 cubic inches. This figures 30 h.p. at 2,650

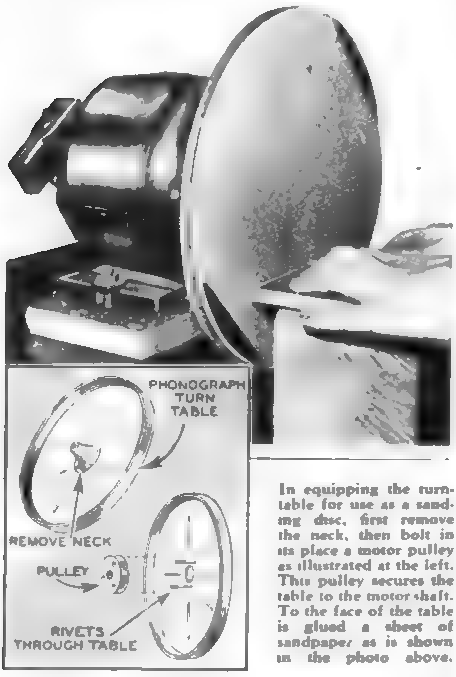
(Continued on page 146)



The rear half of the crank-case and the gear-case. You will notice that in this installment the two halves of the case are treated separately. In the next issue the text carries the whole case as a unit to completion. Do not attempt to drill or finish even the smallest detail until you are instructed to do so, because from the point reached by the manuscript in this issue, each operation is dependent upon some other for its accuracy. Therefore, the routine plan of procedure insures perfect fitting in all parts. Certain points may appear to have been left out of these drafts, (as you will notice in studying castings), but they will be accurately shown in following plans.

CAUTION: To avoid confusion and costly mistakes do not rely on your own judgment for going ahead of the text instructions—wait for the next installment! (Full size blueprints are available from the MM Blueprint Department.) Crank-case castings can be secured from the author if you desire. Address correspondence to Les Long, Cornelius, Ore.

Phonograph Turntable Makes a Handy Shop Sanding Disc



In equipping the turntable for use as a sanding disc, first remove the neck, then bolt in its place a motor pulley as illustrated at the left. This pulley secures the table to the motor shaft. To the face of the table is glued a sheet of sandpaper as is shown in the photo above.

IN MANY homes there are old phonographs lying around in the attic or cellar. If you have one in your home you can use the turntable for a sanding disc on your workshop motor.

First remove the neck that slips on the phonograph spindle (unless it fits your motor shaft) and in its place put on a motor pulley of about 2 or 3 inches in diameter. When the disc and the pulley are properly centered drill holes, running the drill through the holes already in the disc. Then fasten them with rivets or machine screws. Glue sandpaper on the disc and you will have a very fine sander.

Screwdriver Has Light in Handle

WITH the use of a screwdriver now on the market which has a flashlight built into the handle, there's no difficulty in manipulating screws and bolts in poorly illuminated positions. The beam is directed along the shank to the point as shown below. The switch is at head of handle.

Pressure on switch on screwdriver handle directs light along shank to illuminate screw heads obscured by dim light.

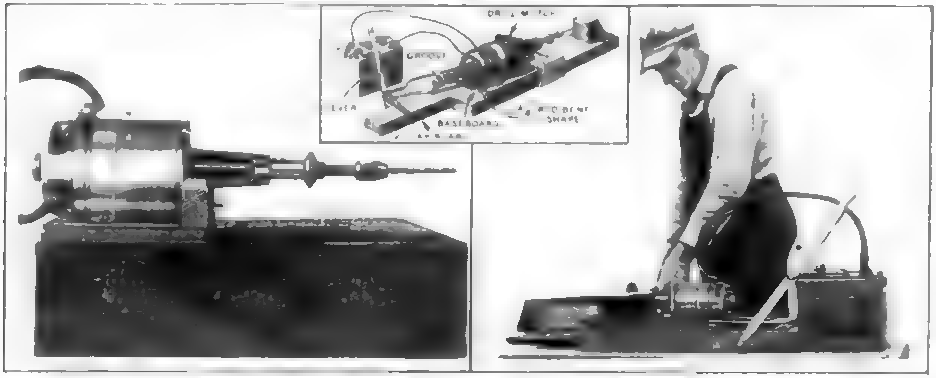
Electric Drill and Saw Made From Starter Motor—Total Cost Only $1.25

FROM a Ford starter procured at a junk yard for two bits and a drill chuck attachment costing only a dollar, one workshop addict has constructed an electric drill which gives the best of service.

Assembly of the drill is illustrated below. The entire mechanism is mounted on an oak board 2"x7"x30". The motor is mounted on a board 1 in. thick, 7 in. wide and as long as the motor. For guides, screw to the side of the bottom board a piece 3 inches wide and 15 inches long.

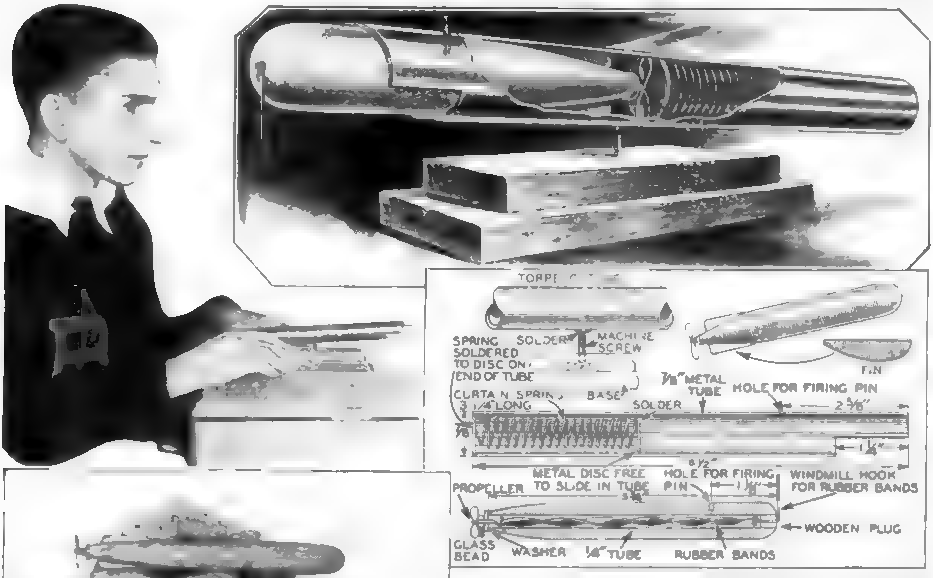
A ⅜ in. rod bent U-shaped should be attached to the baseboard to which the motor is firmly secured. At the other end of the U-shaped rod attach a lever, which in this case was taken from an old binder.

A saw arbor on the drill chuck attachment will also permit the motor to operate a 4 or 6-in. saw very satisfactorily. An ordinary storage battery will furnish plenty of juice.

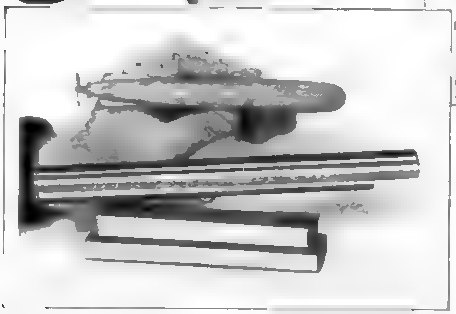


At right is seen method of mounting starter motor on baseboard. Arbor on drill chuck permits use of motor with saw.

Self-powered Toy TORPEDO Looks Real



All sizes and dimensions of the toy torpedo are given in this drawing. Study closely for details of proper fitting, materials used, etc. Note how hook on forward end of torpedo is attached to rubber band and held in place by plug.



In the upper left, the correct position for holding the toy torpedo is demonstrated. Immediately above, the finished product is shown ready to be sent on its journey.

THIS is one of the most fascinating toys that could possibly be imagined. It both looks and acts like a live torpedo and rushes straight to whatever object it is aimed at when released from its tube.

A bit of metal tubing either tin, brass or copper, a piece of a broom handle, a small machine screw, a rubber band and the spring from an old curtain rod completes the bill of materials.

Making the Torpedo Tube

Form the tube by taking a piece of tin cut to correct dimensions and bend it around the broomstick to be used, soldering the seam. Then a little tin disc is cut and provided with a piece of curtain rod spring which is first pulled out from the light coil. Each end of this spring is provided with a small metal disc. The one that is soldered to the end of the tube has a diameter of ⅜ in. while the one soldered to the opposite end has a diameter of only ⅜ in.

After the front of the torpedo tube is cut down as illustrated, we may start on the base. It is made up of two soft pine pieces of the size illustrated. An 8/32 brass machine screw attaches the tube to base. The torpedo has a diameter of ⅝ in. The shape illustrated may be arrived at by the use of a sharp jackknife and a piece of fine sandpaper. Drill a hole lengthwise through the center.

This done, two slits are placed in the stern of the torpedo in the position shown. These accommodate the fins which may be made of light brass, tin or copper. Form the two hooks from copper wire of number 18 gauge.

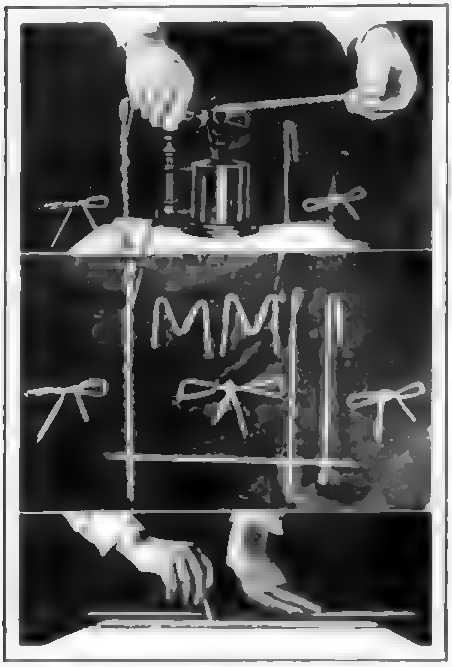
Power Plant Made From Rubber Bands

The aft assembly calls for a small metal washer, and a small glass bead as well as the propeller, which is cut from thin sheet metal and soldered to the end of the copper shaft and hook.

Varnish the torpedo to prevent it from warping from repeated duckings. Then we are ready for the launching. The propeller is wound until the tension tells us that the motor has accumulated sufficient power for a trip. Then, holding the propeller with one hand, quickly insert the torpedo in the tube. Friction will take care of matters once the torpedo is in the tube and the holding peg is in place.

In firing the torpedo, a place near water level should be chosen. Otherwise the torpedo will have a tendency to nose dive instead of skimming along the surface as it should. Real war games may be played with this interesting toy if a good sized pool of water is available.

Tricks of Making Unique Ornaments From Window Glass



Glass strips are bent by holding them in front of blowtorch as demonstrated in the top photo. In center are shown some objects you can turn out. Below—How to hold cutter.

YOU who have been dabbling with wood and iron are apt to think of window glass as being quite unworkable. On the contrary, glass, with little heat, is quite ductile and can be used to shape some unique and useful objects.

All you will need is a blow torch, straight-edge, a ten-cent carbon wheel glass cutter and some thin waste strips of glass. Sighting along the edge of the glass you will note that it is slightly bowed. Lay it, bowed side up, on the bench and place the straight-edge for a $\frac{1}{4}$" to $\frac{1}{2}$" strip. When cutting exert just enough pressure so you can feel the wheel biting into the glass, drawing it rapidly along the straight-edge without stopping. Then quickly pick up the end of the glass nearest you and, with one of the notches in the cutter, take hold of the strip you have cut near the end, pry outward and slightly forward, and the strip will come off nicely.

Hold the glass strip in the flame as shown at the left, exerting a slight twisting pressure. You will be surprised at the ease with which you can begin twisting after a few moments. The glass does not heat much outside the flame but it is best to wear gloves. When finished hold the part heated last above the flame a few moments to cool slightly so it will not break.

You will no doubt find numerous things you can make. The bow knots will be a little more difficult, unless you have an assistant.

Porcelain Houses Need No Paint

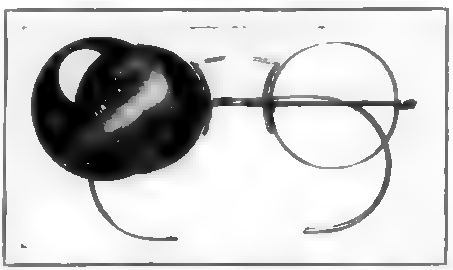
AND now they're making houses out of porcelain!

Shown in the photo below is a home being erected in the suburbs of Cleveland, Ohio, which has all the features of the new houses. The frame is of steel, the roof of steel-enamel shingles, and the walls of porcelain enamel.

Severe tests have proved that the new material has all the staying qualities of the best of other materials, and that the house is decidedly fire-proof. The chief advantage is that enamel walls will eliminate the necessity of a frequent and costly painting.

Something new in houses. Built of porcelain and steel enamel this house never needs painting and will not burn.

Spectacles Improve Marksmanship



New shooting spectacles now on market which have discs with small apertures to confine field of vision and give sharper focus on target. Fits either eye of shooter.

SHOOTING fans desirous of improving their marksmanship will welcome the shooting spectacles, shown in the photo above, which have just been put on the market. The device is equipped with a metal disc with apertures five hundredths of an inch in diameter which confine the field vision to the small area necessary for focusing on the target, thus sharpening the definition and reducing illumination. Different apertures are available for shoulder, hip and arms length shooting, and the device may be employed for either right or left eye.

MOTOR MECHANICS

Edited by RAY F. KUNS

Hot Air Keeps Frost, Steam off Windshield

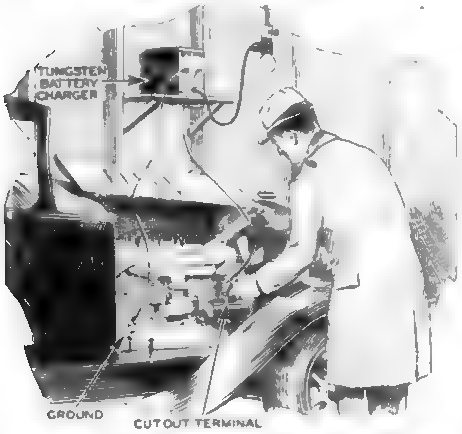
WITH a length of rubber tubing and an aluminum funnel you can arrange a heat-transferring system that will keep your windshield clear of inside frost and steam. Simply place the funnel where it will catch warm air currents from the car heater, slip one end of the rubber tube over the funnel spout, and attach the other tube end where the air from it will spread over the windshield surface in front of the driver or passenger.

The outlet end of the tube need not be fastened permanently in place, but can be equipped with a clip that will enable it to be kept beneath the cowl when not in use, and attached to the windshield only when frost proves troublesome. A rubber suction cup can be fastened near the end of the tube instead of a clip, and pressed against the glass when desired.

In the arrangement illustrated at the right, the clip consists of a narrow strip of copper with one end clamped in a slit in the tubing, and with a short length of smaller tubing slipped over the metal to prevent scarring of the dashboard. The hook is attached to the edge of the dash.

There's no danger of the windshield becoming frosted when hot air is directed over the glass from rubber hose leading up from car heater. The hook permits hose to be attached anywhere on the cowl. Funnel at other end collects heat from radiator.

WHEN the car is inclined to tramp, check the front wheels for balance. You may find a boot in one or wear may have left them out of balance. If a boot is found, remove it or counterbalance with another boot. Weights may be attached to the rim bolts under the lugs to counterbalance.



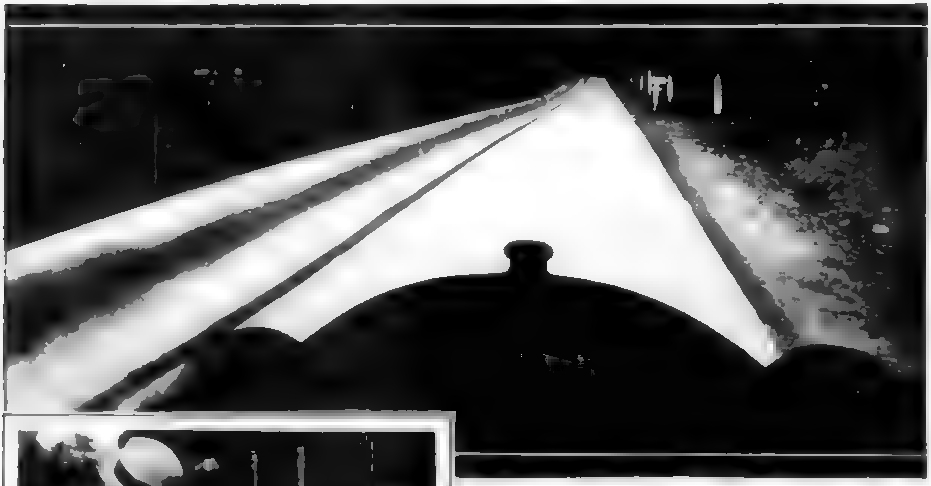
Wire tungar charger to the car battery as shown here.

Radio Charger Boosts Car Battery

THERE are many perfectly good storage battery chargers left over from old battery radio days that can be resurrected, dusted off, and put to work keeping up your storage battery for winter driving. Set it upon a convenient shelf and measure off two wires to the car frame. One of these wires should run to the ground on the frame, the other to the automatic cut-out terminal, as illustrated at the left. This hook-up will put the juice right through the ammeter on the dash, so you can observe the charging rate.

With your old charger thus in service you can keep the storage battery in a good state of charge and prevent many a harsh word on cold winter mornings, since the battery will always be up to snuff and ready for duty.

For SAFETY'S Sake STOP



When headlights are properly adjusted, the road will be illuminated as illustrated in this photo. Note that there is no concentration of light at any point, and that the beam strikes roadside objects at height equal to the height of light from ground.

Government scientist testing four types of headlights for levelness at which they project beams.

All types of headlight lens are given a test for proper diffusion of light in this instrument at Bureau of Standards.

SPEEDING up a state road in pitch darkness an automobile reaches the top of a hill. Simultaneously a car approaching from the other side reaches almost the same spot. Its headlights blind the other driver who, maintaining his rapid pace, fails to follow the exact contours of the road, loses control and crashes into a telephone pole.

This dangerous plight of the night motorist is now in a fair way of being solved, thanks to government scientists in Washington. In fact, virtually every phantom of the night that bothers the driver after dark has been investigated painstakingly by automotive experts of the Bureaus of Standards and Public Roads in the most thorough study of the kind ever made. All motorists will be interested to note the results, many of them surprising, to say the least.

Most modern headlamps, the government specialists found, are capable of producing excellent lighting without objectionable glare—*but* they must be in proper focus and properly aimed.

Proper Focus for Head Lamps

If the filaments are either ahead or behind the focal point of the reflector, much of the light that would ordinarily be directed on the road will be shot up in the air and consequently wasted. After the headlamps have been properly focused they must be pointed straight ahead and adjusted so that the top of the driving beam is slightly below the horizontal. Practically all states require that with the car loaded, on level ground, twenty-five feet away from a vertical surface, the top of the beam should be just below the height of the headlamp centers.

Uncle Sam's experts point out that the driver from his own experience can determine when it is necessary to depress or lower his main beam. The distance depends upon road conditions, weather and speed. On level roads the beam should be dropped when the car is about 500 feet from the passing motorist or sooner if the oncoming driver signals for relief. It should always be depressed when passing over the

that Night Driving GLARE

Motorists can devise their own testing grounds as illustrated here. Beam should be lowered so that it strikes the circle just below the circle on the level with the headlights. If beam is projected level, oncoming motorists will be blinded.

top of a rise, and depressed earlier when the road is excessively bumpy. In short, the lower, or passing, beam should be used whenever the driving beam is apt to cause undue annoyance to the passing motorist.

If, however, he signals for relief when you have your lower beam on, then it's high time to check the focusing and aiming of your headlamps. Here's an easy way to do this yourself at night. First of all, for proper focusing and aiming, your car should be placed on level ground at least 25 feet from a vertical area on which the headlight beam can be projected. A level driveway and closed garage doors serve very well. If the headlights are of the older type—that have a focusing screw, with the lenses in place, focus each headlamp individually by turning the screw right and left until the beam is narrowest in depth. However, most latest types of headlamp equipment do not require focusing adjustments.

For aiming, a mark should be made on the garage doors, or wall, at the height of the center of the headlamp lenses. With the car loaded, the top edge of the beam should be just below this mark, as illustrated in the drawing above. Each lamp should be adjusted separately—either the plug can be removed from the lamp not being adjusted, or a cloth hung over the lamp to cut out the light. Each headlamp should be aimed straight ahead—so the beams from the pair are parallel. This can be accomplished by marking on the garage door, or the wall, the center position for each lamp.

Left—Oncoming motorist has main beam depressed. Road is still well illuminated, yet lights do not give blinding glare. Right—Here is seen glare produced when headlamps are improperly adjusted. Main beam should be lowered at distance of 500 feet from car coming towards you. It's an act of courtesy and prevents many smash-ups.

House With a TOWER is

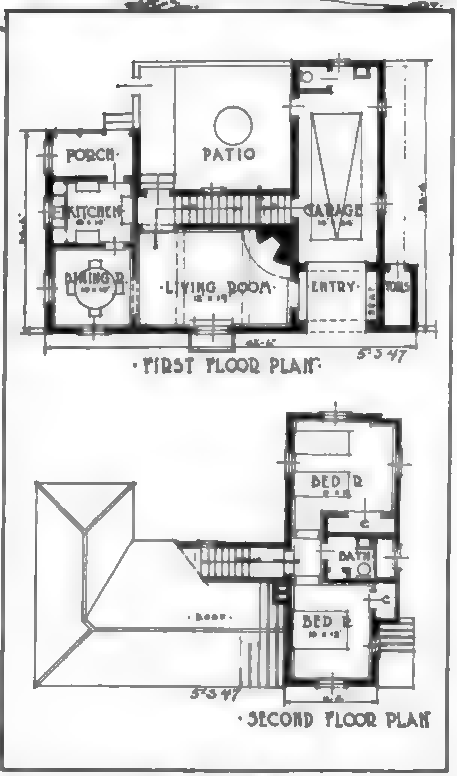
Flat stucco surfaces, high windows, red tile roof and high entry spread a Spanish atmosphere over this house, built from plans No. 5-S-47, which is at home anywhere in the U. S. Grilled windows add that final touch of distinction.

A house with style never grows old—it retains its individuality as long as it stands, and its resale value holds up well through the years. The two houses offered this month carry the last word in style, and they're at home whether in Florida, Montana or Massachusetts.

ANYTHING you pay for whether you get it or not, is style. Your house plan may be the last word in economy of space and the utmost in housekeeping efficiency. Your specifications may call for the best quality of materials and the soundest construction. If, however, the completed house lacks that indefinable something known as style, or atmosphere, or whatever you wish to call it, then your dollars haven't purchased a full dollar's worth.

Style is a mighty important resale factor. And resale value is likewise important provided you've got at least one eye on protecting your investment against too fast depreciation.

A house with a tower is a style of the hour, both figuratively and literally speaking. Tower houses are increasing in popularity. They may never be as common as Dutch Colonials or English cottages but they are up in front of the style parade, and when nicely done with interesting combinations of native materials they are



First and second floor plans for House No. 5-S-47 are shown in the drawing above. The 12x19 ft. living room is featured by a beamed ceiling and corner fireplace. The patio in the rear makes an attractive out-of-doors living room in the summer time. Plans for this house and House No. 5-S-49 may be had by sending $1.00 to Modern Mechanix and Inventions Home Building Editor, 529 So. 7th St., Minneapolis, Minn.

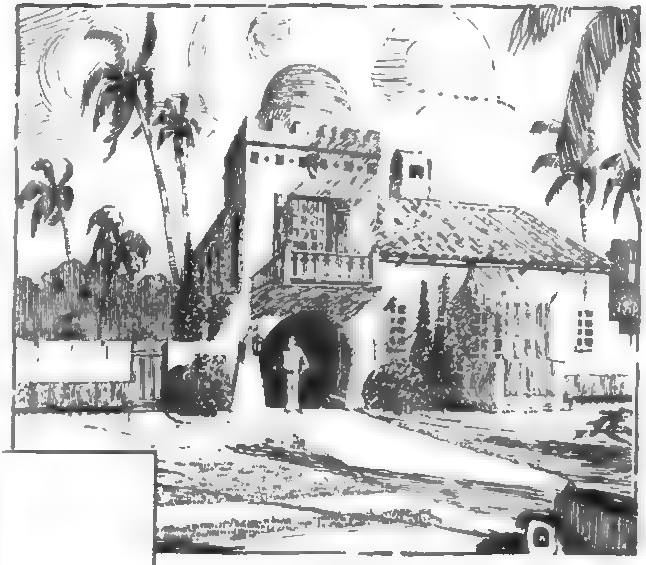
the STYLE of the HOUR

by

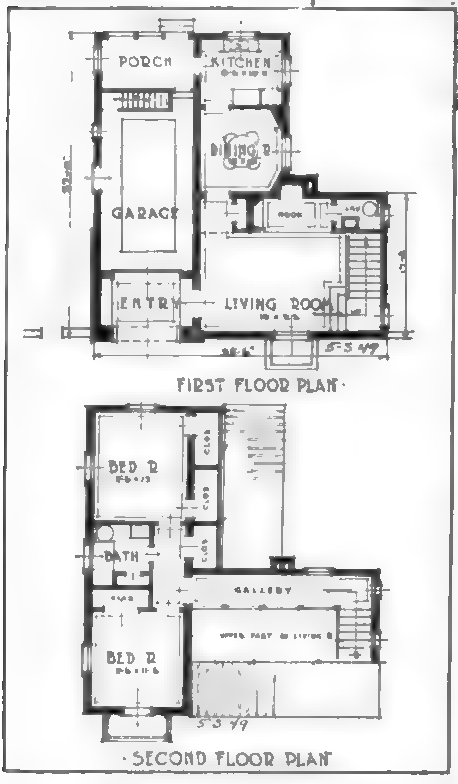
Maurice I. Flagg

HOW TO GET A BLUEPRINT AND TWO PLAN BOOKS

A one-sheet blueprint of any house appearing in Modern Mechanix and Inventions magazine may be had for $1.00, postage prepaid. Two new plan books, "Homes for Newlyweds," containing 32 of the latest ideas for low cost homes in all styles, and "16 Selected Homes for Lean Purses" containing time, space, and labor-saving bungalows, may be had for 15 cents each, or both books for 25 cents, postage prepaid. Address Home Building Editor, Modern Mechanix and Inventions Magazine, Minneapolis, Minnesota.



The dome above the tower and the horseshoe arch over the entrance to the garage give a Moroccan air to House No. 5-S-49. Red tile roof and white stucco walls, with colored tile inserts here and there, heighten the style.



Floor plans for House No. 5-S-49. A decorative feature of this house is the gallery with arched openings in the living room. You pass through this gallery to reach the bedrooms and the bath above the garage. Houses of this type are common in Florida and California, but they are equally appropriate to all states in the Union. All features are designed to answer American needs and yet be distinctive.

not only a pleasing eyeful but frequently look to be worth several times more than what they cost.

A well designed tower not only introduces a highly decorative feature into a small house but it has practical advantages in the way of added space to be used for sleeping purposes, as illustrated in the two new houses designed especially for MODERN MECHANIX AND INVENTIONS readers.

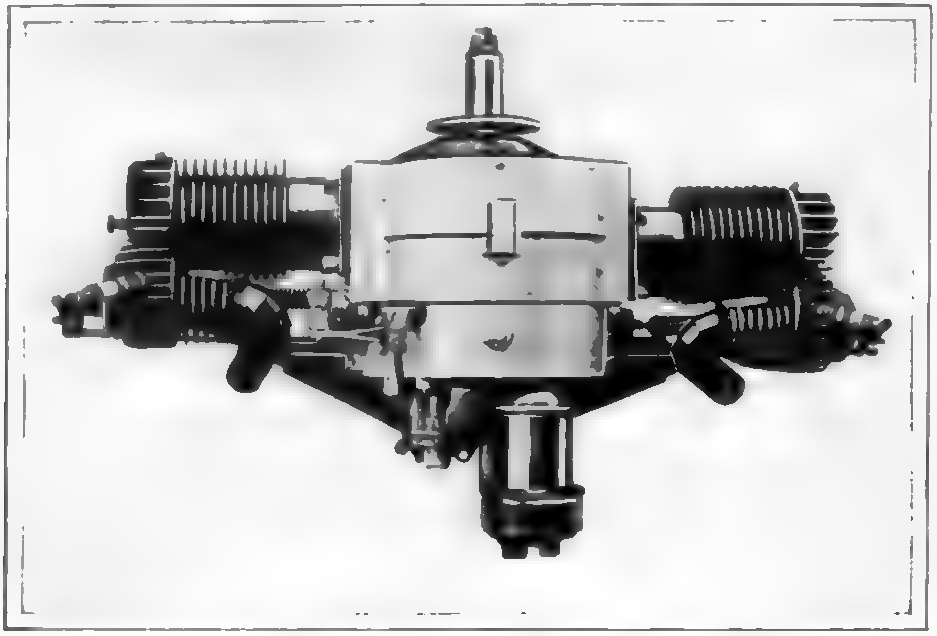
Which brings us to a description of the two houses: No. 5-S-47 and No. 5-S-49. While both suggest certain style and service features common to California and Florida they nevertheless have been planned so they can be built successfully anywhere. When finished they will stand apart from other houses in any neighborhood and will certainly speak for themselves as being "different."

Notice in each house how space devoted to the tower and above the garage has been used for sleeping rooms and a bath. This is a stroke of economy.

House No. 5-S-47 suggests Italian parentage. Its flat stucco surfaces, high windows, red tile roof, arched entry leading into the garage and grilled full length living room window are all Italian features, but here adapted to American needs.

Let's step into the house and see what

(Continued on page 155)

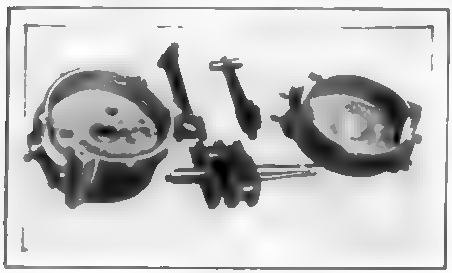


Here's a nice view of the motor from above. Neat, what? The offset rocker assembly seen at the left of the crank-case is mentioned in the cross-section diagram of the motor and is fully explained in a later installment.

and it has all of that. The compression ratio is 5.3 to 1. The weight is 90 lbs. The mounting arrangement is the simplest possible. It sits on a bed rail cast on the crank-case and is held by just 4 bolts. The mount required is almost identical with that used by the Henderson, only slight changes being necessary to mount this on a Henderson mount. This does away with the weight and weakness of a ring mount.

The gas consumption is between 2 and 2½ gallons per hour and the oil used is really too small to measure. Because it has no clumsy built-in oil tank, and has the carburetor bracket set back a few inches, the engine cowls in to a perfect streamline shape. There is nothing exposed but the cylinders.

The front half of the case is a simple job. It is held in the lathe by chucking the main bearing boss in the jaw chuck. It is best to put thin strips of lead or copper in the chuck jaws to keep from marring the casting. After it is squared and centered, face off and cut the oil seal rabbet at the same time to the dimensions shown. Try to get a very neat fit on the offset. After this is done, carefully cut the front main bearing seat. The size given is the standard dimension of the bearing used. It is best to get this bearing first and mike it. The seat should be at least .002 undersize. The little grooves for oil are also cut at this time.



The con-rods, the crank-shaft, and the two halves of the crank-case. Pretty, aren't they?

While doing the turning be sure that you get the measurements right. When the two halves are put together there should be a distance of exactly 4.[illegible]" between the face of the rear bearing boss and the face of the ball race. This leaves .[illegible]" end play for the shaft. The front half should be dipped in boiling water to put in or remove the ball bearing. This bearing is an SKF, No. 5306. It may be had at any supply store.

At this stage the next major operation will be the crankshaft. As stated, it is unusual to expect the ordinary shop workman to do this, but with the instructions it can be done easily and at low cost. The cost is very low, but it takes considerable time to do a perfect job. Go to any good forging shop and ask them to forge out a billet of 6140 chrome-vanadium steel to the size given. Tell them what it is for and ask them to make it flat and true. After it is forged it is to be normalized to a tensile strength of from 110,000 to 120,000 pounds per square inch. This billet will cost about $5.

After you have it, carefully mark, drill and saw it as shown. The three centers at each end must

(Continued on page 150)

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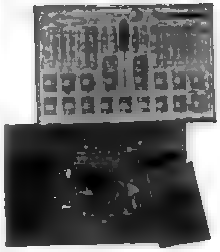

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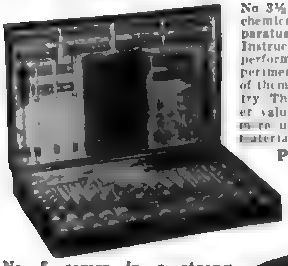

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(Nos. 1, 3½, 5 and 8 are illustrated here)

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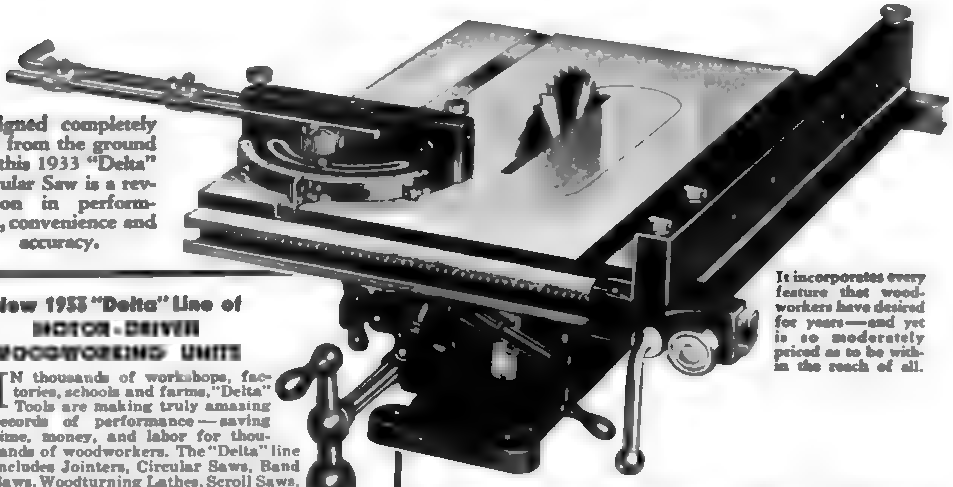

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The Long Harlequin Motor Plans

(Continued from page 146)

be kept perfectly parallel with each other, using a straight edge along their centers and sighting. After roughing out to the shape shown, center up in the lathe, using an outside pair of centers for each throw. Turn with a lathe dog. The throws, or crankpins, are finished completely at this time. Turn down to approximately 1½ inch diameter and put on a high polish with crocus cloth. After these are done the ends are to be sawed off as shown by the dotted lines, and the shaft centered on its true centers and completely finished.

The diameter shown at the front end for the bearing is the standard inside diameter of the 5306 bearing, but it is best to keep the bearing handy and polish the shaft till the bearing can be just pressed on by hand. The rear part is polished to a perfect fit for the bronze bushing in the rear case. The hub taper is the standard taper used in the model T Ford wheel hub. Keep one of these hubs handy and carefully work the taper down till it fits as shown. This hub is now taken and turned to the dimensions shown and becomes the propeller hub. If you have a milling cutter you can cut the key seats, or you can have it done elsewhere. The large one is the standard Ford and the small one at the rear is for the regular Woodruff used in the Harley.

Thread the front end for the hub nut. Tap the rear end for the gear retaining screw. The oil lines require a little care in drilling to keep them straight. After drilling, plug as shown with brass or iron screws. Be sure to blow all shavings out of the oil line. The counter balances are milled or filed from a piece of mild 1025 steel. Make them weigh all alike, approximately 14 ounces each. Bolt them on securely. It is best not to drill the hole in the side of the rear shaft till after the oil line has been put in the main case, so they will check.

This shaft is a thing of beauty and you will be proud of it. It takes more time than any other part of the job, but is worth it. You will learn more doing this than you would in several weeks in a trade school. Use patience and watch your step and you will come out all right. Here it is almost necessary to have the full sized prints which are available from M-M's Blueprint Department.

Let us say right here that this engine can be built by any ordinary mechanic. It requires no special tools. All that is needed is a 16" lathe and drill press. No shapers, planers or special tools are required. Some wrenches, reamers, files, etc., are of course necessary. We are going to do an unusual thing by describing fully how to make the 2-throw crankshaft. This means a saving of at least $50. Very complete detailed instructions will be given for every piece in it so that there will be no question of success. As to the cost, if one has a 23-27 Harley 74 engine the total cost of material will be under $50. You can't beat that.

To come back to the rear half of the crankcase. To attempt making the patterns and getting the castings made would be entirely out of the question for the home builder, but we have arranged to supply the complete set, including the rear cover, of 17ST Dural, for $18, crated. This would be half the cost of the patterns alone. The castings

The Long Harlequin Motor Plans

are finest aluminum alloy and can be supplied on an hour's notice. Editor's Note: All correspondence regarding castings should be addressed directly to Les Long, Cornelius, Oregon.

With the castings at hand they can be fully machined in half a day. Start on the rear half. Looking at the drawing you will notice 3 holes marked X. Drill these ½" and, using long bolts, bolt the case to the face plate with the gear case end against the plate. Shim up till the casting is all square and centered. Take a light cut off the face where the two halves will later come together. We will call this the center line. After taking this light cut turn the case around and fully finish up the gear case end to the dimensions shown. The case is again turned around and the center line end finished. The exact dimensions of the oil-seal rabbet are not critical. With a boring bar cut a 1⅜" hole through the rear bearing boss.

The rear bearing might as well be fitted now. From a piece of bearing bronze turn up a piece as shown, leaving it .002 larger than the hole. It should have a 1" hole through the center. Heat the case slightly with a torch and with the tail stock force the bronze in place. Carefully enlarge the center hole to 1⅛".

The Pietenpol Seaplane Floats

(Continued from page 114)

on each side as you go back. At the step you will find you'll need a channel section. Get the surfaces as flat as possible of course, but in floats like these you can't worry too much about whether the seams will be tight.

No matter how careful you are there will be some little pin hole leaks. The usual practice is to run canton flannel soaked in Jeffries' C quality marine glue along the seam but we found this was the "nerts," to put it mildly. The drill would wind the stuff up, the glue was getting into everything. So on float No. 2 we worked right along in the metal, and then later flooded the seams with a pencil of the glue. It works its way into everything, does this brown, sticky, waterproof, tar-like stuff, and later dries to a dry surface, looking much like gun grease. We got a better job this way.

The mounting of the float will have to be a matter of individual experiment. We show the placing of the float in relation to the Air Camper, which is about as big a ship as these floats can possibly carry and get away with it. The main idea is to have the center of lift come at a 13-degree angle through the center of gravity, and to have the top line of the floats at 2 degrees from the load water line when loaded as shown.

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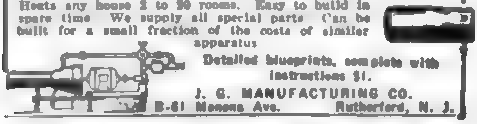

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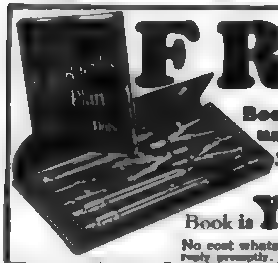

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Let's Invent a Game!

(Continued from page 56)

tacks). At the start of the game the five red lancers are placed in the red prison, and the five black lancers in the black prison. Each of the musketeers is placed on a point of its own color on the field of action.

The game is won by the player who first succeeds in liberating all his prisoners, whether lancers or musketeers, in accordance with the following rules:

Rules of Play

Any man on the field of action may be moved to the next adjacent point on a straight line from it, unless the point is occupied by another man. If the point is occupied by an enemy man, and if the point immediately beyond (on a straight line) is vacant, the enemy man may be jumped and put in prison. Either a musketeer or a liberated lancer may be thus jumped and imprisoned.

When a player has a jump, he must take it. If he can continue with the same man to jump other enemy pieces, he can and must do so. When he has two jumps available with different men, however, he may choose to take either one. (Exception: On a move in which a player is entitled to bring a man out of prison, as explained below, he is not obliged to take an available jump. Liberating a prisoner always comes first.)

Each player has two primary aims which are as follows:

1. To capture as many as possible of his opponent's men.
2. To get his own musketeers into rows of three.

Whenever a player gets three of his musketeers in a row, he brings one of his prisoners out of prison as his next move. If he has a captured musketeer in prison, this musketeer should be brought out. Otherwise he brings out a lancer. A liberated prisoner, whether a musketeer or a lancer, may be placed on any vacant point on the field of action, and thereafter it enters into play as any other man of its kind already in play.

A prisoner is never liberated by forming a **triplet** (three-point combination) with one or more lancers in it. **Triplets** are always formed with musketeers. In other respects lancers and musketeers are played in exactly the same way.

If a player forms more than one **triplet** on the same line during a game, only the first one formed serves to liberate a prisoner. It is not difficult to remember on what lines **triplets** have been formed, but if the players prefer, the points on the board may be numbered and a record kept by noting the numbers in each **triplet**, as it is made, on a sheet of paper.*

At the end of any game, the board should be reversed before a new game is played.

Questions and Answers:

(Q) May a liberated prisoner be recaptured?
(A) Yes.
(Q) When a player brings a prisoner out of prison, does it count as a move?
(A) Yes.
(Q) When a captured musketeer is liberated from prison, may it be placed on a point in line with two other musketeers, to form a **triplet**?
(A) Yes. When another **triplet** is thus formed, another prisoner is freed as the player's next move.

Let's Invent a Game!

(Q) Can **triplets** be made to connect, or intersect, so that one musketeer serves in two three-point combinations?

(A) Yes. A single musketeer may serve in as many **triplets** as there are lines which lead away from the point on which it rests.

(Q) May the same three musketeers be used to form more than one **triplet**?

(A) Yes, any number of **triplets** so long as they are on different lines.

Our game is now finished. It is obviously a pastime that will appeal more particularly to players who have attained at least an age of twelve or fourteen years, and consequently, if we were to put it on the market, it might sell rather slowly at first. Games for adults usually require more exploitation than games for children. This commercial phenomenon accounts for the fact that most of the new games which appear just before Christmas each year in novelty shops and in the gift sections of department stores, are designed for younger players. In the long run, however, an attractive game for adults, or a game like Touring or Ping Pong, which both adults and children may enjoy, is likely to achieve greater success. This truth is apparent when one considers the best sellers of the past thirty years. They are Pit, Flinch, Rook, Touring, Ping Pong, Halma, Pachisi or Parcheesi, Pollyanna, Mah Jongg, Backgammon, Camelot, and of course those perenially popular old-timers, playing cards, chess and checkers.

*** This game has been examined and approved as worthy of commercial exploitation by Mr. F. L. Ordway, game expert of Parker Brothers. Any person desiring to construct a model of it for home amusement, is granted permission to do so; but its manufacture for sale, or barter, is expressly forbidden.**

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(See adv't. "Brainy Meals," p. 8; "Foresight, 98%," p. 150; "Control Sex Force by Food," p. 81.)

Race 'em All in Double-M Ice Yacht

(Continued from page 105)

1½-inch hem on the two sides in which we will put grommets, and a single one-inch hem along the leach. (See Fig. 2.) In cutting the canvas, reverse each succeeding strip as in laying the cockpit floor. Sew the strips together with simple lapped ¾-inch seams and then lay out again and mark the finish lines.

This can be done with a chalk line after the sail is smoothed out or with a string and pencil. Get the edges straight or curved out just a bit in the center. Lay a quarter-inch rope in the two large hems which will be kept at the outer edge. After the hem is sewed up, loop the end of the rope at an outer corner so that a grommet will come inside the loop, draw the rope through until it lies smoothly, and then sew up snugly at the other two corners.

Through the small hem, run a heavy seine twine which will be secured at the peak but brought out at the lower end. This will tie to the boom and will be used to adjust the "draft" of the sail. The skipper will draw it up to make the sail "belly" for light air and flat for high winds.

It should never go slack as that would let the leach flap and no good sailer allows that. Grommets can best be set by a sail or awning maker but possibly one will rent or loan the builder the tools. The outfit is really inexpensive and worth the price to make a good job. Small rings can be sewed along the edge in place of grommets, making sure to sew over the rope so they won't pull out.

The stays, of which there are three, should be of 7 stranded wire cable with a loop spliced at the upper end to slip over the head of the mast. The lower end should carry a thimble large enough to get four or five strands of ¼-inch rope through.

Make the stays a foot short of reaching the rings on the boat so there will be space for adjustments with the lanyards. (See Fig. 2.) Acid core solder is ideal for soldering the splices. The popularly used wire clothes line is not suitable for stays.

As shown, a check line is needed to keep the sail from swinging forward when hoisted and also a line around the mast and boom. These should be tied so adjustment can be made from time to time. The sheet line is fastened to the end of the boom, down to a block at the stern, up to a block on the boom and down into the cockpit to a cleat. A large wooden one is best for bemittened hands and is more safe, should the crew slide into it suddenly.

This should be a good outline for a real sailing ice yacht but can be altered in detail to suit the desire or pocketbook. Lots of things can be changed to cut costs or for improvement, but it is recommended that the general dimensions be maintained.

Paint is more durable than varnish and is being used on many ice yachts because of the color it gives the sport. One of the accompanying photographs shows a fleet of these ice yachts, each with a different colored sail, creating a colorful spectacle.

House With Tower Is Style of Hour

(Continued from page 145)

it offers in style, service, equipment and cost. A living room 12 by 19 feet is featured by a beamed ceiling and corner fireplace. This room opens directly onto a corner dining room which in turn opens onto a small but efficiently planned kitchen.

Concealed stairs lead from the living room to two bedrooms and bath above the garage. You may ascend a step and then down a step from the living room into an open patio at the rear of the house. A pool, velvety green lawn, and sparkling garden furniture will make the patio an attractive out-of-door living room for summer days.

And that's the story briefly of the little house, except to say the construction calls for hollow tile walls with stucco finish, and a red tile roof. Asbestos shingles may be substituted for the red tile roof. The designer says the house is within the $5500 price range under normal conditions. But costs vary depending upon location and equipment.

Plan No. 5-S-49 suggests Moorish influence. In this plan the dome is really a watertank because in certain sections of the South and West, soft water is essential and rain water is the source of supply.

An interesting feature of this house is the gallery with arched openings in the living room. You pass through this gallery to reach the bedrooms and bath above the garage. Other features are a fireplace nook with seat and a lavatory beneath the stairs leading to the second floor.

This house is a stucco job with red tile roof. Colored tile inserts in the walls here and there will add to the Moorish style qualities. There's a small basement or full basement if you wish. In warm climates a cellar is not necessary.

While the plan calls for hollow tile construction the house may be built of frame with stucco exterior on metal lath.

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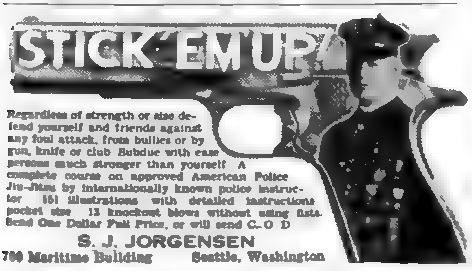

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Puzzles Test Intelligence of the Ape

(Continued from page 72)

involve insight and understanding, it is by no means so clear that the chimpanzee holds first place.

"The gorilla's concentration of attention, deliberateness, and self-dependence are unexcelled assets, whereas the impulsiveness of the chimpanzee may be a serious disadvantage. My guess is that the order of diminishing ability for learning as the result of trial and error is chimpanzee, orang-utan, gorilla.

"On the other hand, the gorilla leads in its ability to form new ideas and execute them, while the orang-utan is second in this respect and the chimpanzee third."

The chimpanzee is a child of moods and temperaments. It loves applause; is a natural and gifted actor, always ready to imitate humans and other animals, full of play, optimistic, loyal, dependable—the showman's prize.

The gorilla, on the other hand, is a clumsy, awkward animal, slow to anger, crafty, cunning, far-sighted, deep, reserved, cool and calculating in its movements and indifferent to human acts and expressions.

Make Old Silverware Look Like New

(Continued from page 121)

necessary first to deposit an under-coat of copper. The solution used on the job is a **dangerous** mixture and the greatest caution should be used in its preparation. First a half ounce of sodium cyanides (beware!) and three ounces of caustic soda are dissolved in about a half gallon of water. The chemicals are dissolved in the order named and then one quarter ounce of copper cyanide is added and dissolved. A copper coat of fine grain is plated on the inside of the metal cups in the manner illustrated in Fig. 6, using an iron electrode connected to the positive pole of the battery.

This done, the inside of the freshly-cleaned and plated cup is washed thoroughly in clean, warm water which is permitted to remain in it until the gold preparation is made. This is done by dissolving one-half ounce of neutral gold chloride and one and one-half ounces of potassium cyanide (beware!) in one quart of distilled water.

It will be necessary to let this solution stand for at least two days before it should be used. Then it is poured into the cup up to the very brim (after a carbon electrode has been suspended from above. See Figs. 4 and 6). The plating is carried on with not more than one and one-half volts from the battery.

In this case, a soft gold surface will be produced and it will need no polishing for the dull finish inside these cups is much to be desired. Naturally when the plating has been disposed of, the cups are washed out with warm water and dried.

Social responsibilities should be carefully remembered after the mechanic has finished using these deadly poisons, and they should not be left standing about even for a few minutes. If the solutions are not to be used again, a hole should be dug in the back lot and they should be poured into it and buried.

Fight Artillery Duels in War Games

(Continued from page 129)

the floor, table, or a chair. Place one or more battleships or box targets just beyond the extreme range of the mortar. Move the targets toward the mortar zig-zagging if desired, about 4 to 8 inches at a move. The mortar is allowed 2 to 4 shots per move. The ships win if over half of them reach some designated point.

An interesting variation is to lay out a map and prepare data as shown in Fig. 1. Still another variation is to have the mortar located where its gunner cannot see the ships, the firing being directed by an observer. Or a whole area may be laid out and data prepared as in Fig. 5. The observer then reports only the location of the ship and the gunner uses the data for pointing his mortar.

Moving Targets. Couple two or more ships (as many as can be pulled) to the tractor and fire at them as they are drawn past an open doorway or between two marks on the floor. Allow unlimited firing or allow some definite number of shots, perhaps about 10 or 15 depending on the range, speed, etc. The tank can be used as a moving target in a similar manner.

Artillery Duel. Many interesting contests can be arranged if two mortars are constructed. The general rules for such contests are as follows: Locate the mortars on the floor or on tables about 10 to 12 feet apart. Mark off an area in front of each about 3 by 5 feet. Place forts and ships in this area an equal number on each side.

At a signal each side begins to fire. The contest ends when all forts and ships on one side are destroyed. This game may be varied by allowing three shots at a time on each side and then moving the ships to any new location in the marked off area. Then another three shots are allowed until one side is destroyed. This game may also be played by having an observer on each side and low screens provided as in Fig. 1 to hide the targets from the gunner.

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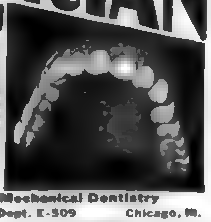

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Scientists "Steal Snow" for Power

(Continued from page 81)

the course in summer and ending with correlation of the data, each step is taken with care. The courses are selected where the snow lies uniformly. The markers are placed at right angles to indicate a major and a minor course. These sometimes are 500 feet long, and samples are taken every 25 feet.

Snowed in for the winter, the surveyors enjoy the mountain solitude with their families. Often two days are required to cover several courses, the most distant possibly 20 miles from their cabin. For safety's sake, they work in pairs.

Often their houses are covered by snow. Henry Merema, one of the California "thieves," tells of standing frequently on the snow and looking into his own attic. Occasionally the men leave home through the front door and return to crawl down through the roof.

Fortune Making Ideas for Inventors

(Continued from page 89)

felt before, are beginning to see the need of a new method of closing and opening ink bottles. I turn the problem over to my ingenious readers with the feeling that one of them will be able to meet this need and, having met it, will be rewarded in real money.

Specifications: Must add little if anything to the cost of a bottle and ink may be taken from the bottle without the necessity of removing the cork.

Exploitation: If the inventor can afford it, this invention should be patented in all of the leading countries of the world.

4. Electric Shoe Polisher

One is amazed at the things that are done electrically today. A little sober reflection will convince any inventor that we still have many, many things that may be done by pushing a button. There is the matter of domestic shoe shining as an instance.

What we need is something that the whole family may go to on Sunday morning and use without any danger of getting dirty fingers or soiling the clothes. The polish and the cleaner must be applied automatically, perhaps by some entirely new method and the brush must be driven by an electric motor of small power.

Specifications: The cost of such a machine should be kept under twenty dollars if possible. Such a machine will also be more or less useless unless the inventor provides at the same time a method protecting fingers and clothes. The annoyance of getting soiled fingers will be a patent selling point.

Exploitation: This idea should be patented in the United States alone for luxuries of this type cannot be bought by the average European family.

5. A Kingdom for a Corkscrew

The old-fashioned corkscrew has no place in this civilization of ours. First off, it is utterly impossible to remove corks from small bottles with this outrageous invention. Then, too, even large corks are practically destroyed when they are removed in this fashion.

Fortune Making Ideas for Inventors

Why not a cork remover built on the principle of an expansion bolt, an expanding barb or some other sound mechanical principle? The object should be sharp and pierce the cork with great ease and a handle should be provided that would give a good grip.

Time and time again, I have maintained in this department that it is the little things that make the money and once more I say it in connection with this million dollar idea.

Specifications: This thing must be sold in the five and ten cent stores and millions would be disposed of in this way if the idea worked at all well. It may be made of anything, wire, pressed metal or wood, as long as it performs perfectly.

Exploitation: Should be patented in all of the large countries of the world.

6. Control of Bath Temperature

While some of the very expensive bathroom fixtures may have means of providing control of temperature for shower baths, we still have to have the type of bath water control for ordinary home use and for use in connection with bath tubs.

How nice it would be to have a lever on the faucets of a bath and to be able to set that lever at 70, 85 or 95 degrees, depending on the temperature at which we wanted to bathe.

In making this suggestion the writer has in mind an attachment that would be fastened to a water faucet between the faucet and the source of water. It would be logical to suppose that such temperature control might be based on the expansion of metals much as the temperature of the click flatirons is controlled.

The orifice through which the hot water passed would simply be made smaller or larger depending upon the temperature of the hot water. If the water was extremely hot, the metal would expand and so close the hot water passage that only a small amount of water would succeed in passing through. Such a system would require no complication, no moving parts whatsoever and certainly nothing to get out of control or to need repair.

Specifications: The cost of such equipment may run as high as $15 per installation but it would appear possible to develop a device that would be sold for much less. The temperature should be controlled simply by a small lever or dial with a scale that would contain the limits of temperature between say 50 degrees and 120 degrees, the two utter extremes.

Exploitation: It would be useless to patent this device in many foreign countries for the bathtub is largely a purely American idea. Very few bathtubs are used in Europe. In fact, they are rented out in France.

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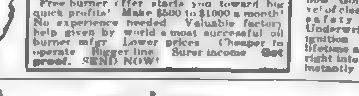

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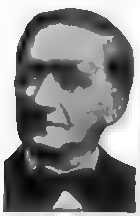

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Machines That Pick Your Pocket

(Continued from page 38)

season for his half of the spoils. To outward appearances he is the well-groomed, prepossessing business executive, spending his summer vacation away from the traffic encounters of the cities. Actually, he is just another of the oily band of scum whose depredations are designed to make bums out of upright American citizens.

Many a mayoral candidate wins voter confidence by shouting and fuming eternal damnation to vice and gambling menaces. Most candidates include a slot machine plank in their platforms. And always, after election, slot machines are knocked down and dragged out: for a while. Usually, after two or three short months, the slot machine pledges go the way of all pre-election promises. Police officers frequent places of business which operate slot machines—and (under orders) see them not. In most cities, a private citizens must swear out a specific complaint before police will confiscate them.

The self-styled "enormous $10,000,000 Institution" which leads the universe in slot machine manufacture prints a handsome service manual and parts price list for its customers. It reminds them: "In Coin Machine Operating, close harmony and cooperation between Operator and Manufacturer is essential for the success of both. Realizing this fact the . . . Company is constantly offering to operators—new machines—new ideas—new money-making plans."

Of course, no anxiety is voiced for the success of the man who plays the slot machines. He is merely so much "sucker money." "Keep in touch with us," the brochure continues, "and you will have the pleasure of knowing that you are affiliated with the biggest, best, and most successful business of its kind in the world."

Truly, the Operator and Manufacturer are determined on cooperation and "close harmony": nothing is so tuneful and so satisfying to the ear as the sound of the jackpot pay-off. But for those of you who play their machines—"life is just a bowl of cherries"—and the cherries will never pay enough to make you rich!

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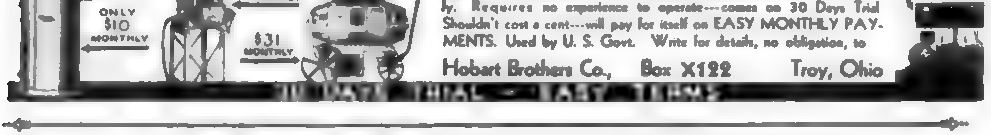

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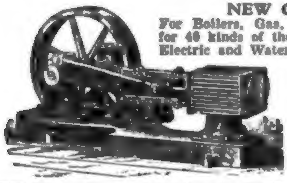

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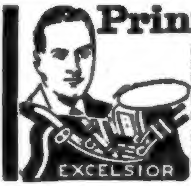

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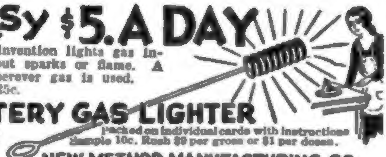

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